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# Bangladesh's Final Report to DfID

## Reaping the Benefits: Assessing the Impact and Facilitating the Uptake of Resource Conserving Technologies in the Rice-Wheat Systems of the Indo-Gangetic Plain

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**Analysis and compilation by Sam L J Page, CABI UK**

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Data collected by Elahi Baksh & team. Analysed and compiled by Sam Page, CABI.

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## Boxes



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## *Executive Summary*


1. The goal of this DfID-funded project was to improve rural livelihoods through accelerated adoption of resource-conserving technologies.
2. Farmers in villages in the Dinajpur area were assessed according to family size and landholding in order to determine their Rice Self Sufficiency Indices and assign them to one of four socio-economic groups, i.e. Landless, Marginal, Subsistence and Food Surplus.
3. All farmers complained that yields from the old *Kanchan* wheat variety were low and that hand threshing was extremely laborious and a serious constraint to increased wheat production.
4. Results obtained from Output 1 of this project showed that all four socio-economic groups of farmers can obtain increased wheat yields of between 40 and 80% by planting seed from the new *Shatabdi* variety. However, due to seed shortages at official outlets, few farmers had been able to access it.
5. On investigating the various ways in which farmers access information regarding new technologies under project Output 2, it became clear that despite being in the majority, Marginal and Landless farmers, including women, are normally excluded from traditional forums for technology transfer, such as demonstrations and field-days, while there are a number of constraints to accessing improved seed from BADC, including seed shortages and poor quality control.
6. In order to optimise pro-poor development, scientists from WRC collaborated with field-workers from the local NGO, DIPSHIKA. This team was tasked with empowering Marginal and Landless farmers through Whole Family Training to take control of *Shatabdi* seed production as an income-generating activity in order to improve access to this technology for all socio-economic groups.
7. This process has been highly successful with Food surplus and Subsistence farmers being amongst those buying the high quality seed and some Marginal farmers being approached by BADC to supply more seed in future.
8. The trained Marginal and Landless farmers have been able to make considerable improvements to their livelihoods by selling high quality *Shatabdi* seed from 0.08 ha plots, in terms of all five capital assets.
9. Research results indicated that threshing machines were having zero impact on Marginal and Landless farmers in terms of either reducing drudgery or increasing income. Some Landless farmers had reduced employment opportunities due to the mechanisation process.
10. Furthermore, without external support, these farmers were unlikely to ever gain control or even access these machines due to their limited landholdings and financial poverty.
11. WRC scientists and DIPSHIKA field-workers were able to create an enabling environment, using training, local manufacture and micro-finance to reduce the risk involved for Marginal farmers to set up wheat threshing services.
12. Again this process was highly successful in terms of creating a win-win situation whereby the poorest farmers were able to take control of the threshing machines in order to generate income, thereby improving access to this service by all socio-economic groups.
13. It is expected that the Marginal farmers will be able to complete repaying the loans they took to purchase the threshing machines within three years.
14. This work has shown that traditional technology dissemination methods which favour Food Surplus and Subsistence farmers because of their ability to take risks discriminate against risk-averse Marginal and Landless farmers. Whereas optimal uptake can result from dissemination methods that focus on the needs of the poorest.
15. This means providing sufficient training and financial support to Marginal and Landless farmers (including women) to enable them to take control of new technologies in a way that ensures equal access by all.
16. Plans are being made to scale this work up to reach more than 10,000 Marginal/Landless farming families in wheat-growing areas of Bangladesh.

## Acronyms

BADC = Bangladesh Agricultural Development Corporation

BARI = Bangladesh Agricultural Research Institute

CABI = CABI

CIMMYT = International Maize and Wheat Improvement Centre

DAE = Department of Agricultural Extension, Bangladesh

DfID = Department for International Development, UK

NARS = National Agricultural Research Stations

NGO = Non Government Organisation

RCTs = Resource-Conserving Technologies

RSSI = Rice Self-Sufficiency Index

SDC = Swiss Agency for Development Co-operation

Tk = Taka (USD1 = Tk68 in 2005/06)

USD = United States dollar

WRC = Wheat Research Institute, Bangladesh

# *Introduction*

## Project Goal

Improved rural livelihoods through accelerated adoption of productive, appropriate and sustainable agricultural practises:

- Increased incomes and social benefits
- Increased productivity and food needs met
- Sustainable agro-ecosystems

## Project Purpose

To maximise opportunities and options for livelihood improvement by ensuring the relevance, impact and sustainability of new production mechanisms to optimise uptake of beneficial practises to all social strata involved in agriculture.

## Project Implementation

This DfID-funded project was implemented by scientists from CABI-Europe and CIMMYT South Asia, in collaboration with NARS scientists and local NGOs, under the auspices of the Rice-Wheat Consortium, at five sites and with rice-wheat farmers inhabiting villages across the Indo-Gangetic Plain:

- Dinajpur, Bangladesh (Wheat Research Centre + DIPSHIKA)
- Basti, Faizabad, India (Narendra Deva University of Agriculture and Technology)
- Varanasi, India (Institute of Agricultural Services, Banaras Hindu University)
- Belwa and Benauli, Terai Region, Nepal (Nepal Agricultural Research Council + CIMMYT Nepal)
- Sheikhupura and Sailkot districts, Pakistan (CABI Pakistan)

## The Bangladesh Team

In Bangladesh, the Principal Investigator was Dr Sam L J Page, Farmer Participatory/Rural Livelihoods specialist, CABI-Europe and the Regional Co-ordinator was Dr Etienne Duveiller, Wheat Pathologist, CIMMYT, South Asia, with assistance from CIMMYT Bangladesh. The Site Manager was Dr Motiur Rahman, Director of the Bangladesh Agricultural Research Institute and the research scientists, led by Dr Elahi Baksh, Agricultural Economist and Rice-Wheat System specialist, were from the Wheat Research Centre (WRC) Dinajpur. WRC scientists collaborated with field workers from DIPSHIKA, a local NGO that focuses on training, business planning and the provision of micro-credit to improve the livelihoods of the poorest farmers.

*Fig. 1. Dr Rahman and colleagues at the planning workshop Dhaka, December, 2004*

## Selection of Improved Technologies for Increased Wheat Production

For the purposes of this research, the Bangladeshi team chose to investigate access and control of two improved technologies for wheat production, namely an improved variety of wheat, known as "*Shatabdi*" and a small, open-drum, wheat threshing machine. These technologies had both been prioritised by farmers and researchers: Researchers were keen to promote *Shatabdi* as a way of reversing the decline in wheat productivity in Bangladesh, while farmers had highlighted hand threshing as being the biggest constraint to wheat production.

*Fig. 2. Woman hand threshing wheat*

## Using a Livelihoods Approach to Target the Poorest Farmers

The adoption of new technologies which impact on crop yields and/or household budgets pose a threat to the livelihoods of resource-poor farming families in terms of their food security and income, thus it is that only those farmers who have sufficient land to guarantee household food security throughout the year that can take the necessary risk. In an effort to target the poorest groups with our research, the following socio-economic categories were drawn up according to their ability to take risk:

- **Landless/food deplete farmer:** Must rent land or do paid labour to get food and pay for other necessities. *Cannot take any risks.*
- **Marginal/food deficit farmer:** Has insufficient land to achieve household food security. Regular shortage of food and cash. Must do labour in order to buy additional food, inputs and other basic necessities. Can enter a downward spiral very easily. *Cannot take any risks.*
- **Subsistence/self-sufficient farmer:** Has sufficient land to meet basic food needs under normal conditions. May need to do labour to pay for inputs and other necessities (including school fees). Remains vulnerable to economic and environmental shocks. *Is risk averse.*
- **Food Surplus/cash cropping farmer:** Has sufficient land to guarantee household food security. Able to produce surplus grain and cash crops for sale to buy inputs, send children to school and accumulate 'middle class' assets, e.g. bicycle, TV, electric fan. *Able to take risk.*

According to this classification, only Subsistence and Food surplus farmers are able to take risk and therefore it is these farmers who are most likely to adopt new technologies. However, in order to ensure that all farmers covered by this project were placed in the correct category each household was assessed according to its capacity to be food secure on an annual basis; see Box 1.

**Box 1.**

**Assessing household food security for rice farming households**

The ability of farmers to achieve household food security is based on their landholding, number and ages of dependents and expected yield of their staple food crop. For rice growing farmers this can be expressed according to the following formula:

$$\text{Rice Self-Sufficiency Index (RSSI)} = \frac{\text{Potential paddy yield} \times \text{Landholding}}{\text{Annual paddy requirement}} \times 100\%$$

According to FAO, the recommended annual energy intake for an adult is equivalent to 365 kg of (unprocessed) paddy rice, for an adolescent child over 10 years this is 274 kg per year, while for a child under 10 years it is 183 kg. The annual paddy rice requirement for each household can thus be calculated once the numbers of dependent adults, adolescents and children under 10 years are known.

The farmer's own yield data in terms of kg of paddy/ha is used to calculate the RSSI for each household. In cases where the farming families are sharecropping, the amount of grain that is due to the landlord must be subtracted from the potential yield.

The rice self sufficiency index (RSSI) for Landless farmers will normally be zero, while the RSSI for Marginal farmers will always be less than 100%. For the purposes of this research, the RSSI for Subsistence farmers was set at between 100 and 200%, while for cash-cropping farmers an RSSI of more than 200% was used.

Adapted from Page & Chonyera, 1994. Development Southern Africa, 11 (3) 301-320.

*Fig. 3. Women's group in Jagdal village*

## *Output 1: "Implications and benefits of new technologies on social well-being and system productivity and sustainability determined and key beneficial practices identified for each agro-ecosystem and social group within each community at selected benchmark sites."*

## 1.1 Methodology Used to Determine the Impact of these Technologies on the Different Socio-economic Groups of Farmers

In order to obtain data that would allow farmers to set the agenda within a framework of relevant areas and give their own unbiased views on access to resource-conserving technologies (RCTs) the teams were provided with templates for conducting informal case studies. These focused on specific areas such as gender, socio-economic impacts, pest incidence, and institutional support. The teams were also encouraged to interview the farmers in their own homes, rather than in groups, to prevent intimidation from more powerful neighbours. The Bangladeshi team preferred to transpose this template into a more formal questionnaire in order to conduct a survey with farmers, mainly in their own homes. The information provided by the farmers is set out below.

## 1.2 Livelihood Impact Assessment of Improved Wheat Variety, *'Shatabdi'*

The new, improved wheat variety, '*Shatabdi'* (or 'Millennium') was released by the Wheat Research Centre (WRC)/Bangladesh Agricultural Research Institute (BARI) in 2000. The parent lines for this improved variety were obtained from CIMMYT, Mexico in 1988 and local scientists selected out the best crosses from this material according to local conditions. It is a semi-dwarf variety with good tillering ability and has a duration of 105 to 110 days. This variety is resistant to rust and highly tolerant to leaf blight and is said to be the most outstanding variety so far suitable for the rice-wheat cropping system in Bangladesh. According to WRC, yields of up to 5,000 kg/ha can be achieved by this variety and it can out-yield the previous variety, '*Kanchan*', by at least 20%. Due to seed shortage, *Shatabdi* also fetches a higher price when it is sold in local markets as seed.

In 2003 this new variety was disseminated to groups of farmers by scientists from WRC, during demonstrations held in the villages of Daulatpur and Jagdal. In order assess the impact of *Shatabdi* on these farmers they were compared with neighbouring farmers who did not attend the demonstration (and were therefore non-users of *Shatabdi*). The users and non-users were questioned about the number of dependents, landholding and annual rice surplus or deficit in order to determine whether they were Marginal, Subsistence or Food surplus farmers. Information on wheat yield, increased income from *Shatabdi*, extension visits and constraints to wheat production was also collected. All the non-users were continuing to cultivate the old wheat variety, *Kanchan*.

### 1.2.1 Results of interviews with farmers in Daulatpur village

A total of nine users and nine non-users of *Shatabdi* were interviewed in Daulatpur.

**Users of Shatabdi**

*Marginal farmers*

The three Marginal farmers who were interviewed in Daulatpur village had family sizes ranging from two adults and two children to seven adults, two adolescents and three children. These farmers had landholdings ranging from 0.2 to 1.46 ha indicating RSSIs of between 44 and 97%. Two of the Marginal farmers had obtained yield increases of more than 90%, while the third achieved a yield increase of 37%, once he had switched to *Shatabdi,* representing an average increase in income of Tk8,130, see Table 1. These farmers reported that they had never been visited by extension and complained that threshing the wheat crop was their biggest problem.

*Subsistence farmers*

Only two of the users that were interviewed in Daulatpur had an RSSI of between 100 and 200%. Although these farmers had the same paddy requirement, their widely differing landholdings (0.64 and 1.14 ha) gave them RSSIs of 106 and 190%, respectively. The poorer of these two farmers had obtained a yield increase of 200% as a result of changing to *Shatabdi.* Both farmers benefited from an increased income of more than Tk10,000 (USD158). Only one of the Subsistence farmers reported extension visits. Both farmers mentioned excessive rainfall at harvest time and hand threshing as major constraints to wheat production, see Table 1

*Food Surplus farmers*

Four of the users were identified as Food Surplus farmers. These farmers had an average family size of four adults, two adolescents and one child under 10 years, with an average land holding of 2.37 ha. This ensured a mean RSSI of 303%. By changing to *Shatabdi* these farmers had increased their wheat yield by between 27 and 74% (a mean of 49%), with an increased income ranging from Tk11,183 to Tk31,979, see Table 1. Two of the farmers were regularly visited by extension. Again weeds and excessive rainfall at harvest time were reported to be major constraints to their wheat production.

**Non-users of *Shatabdi***

*Fig. 4. Men's group in Daulatpur village*

*Marginal farmers*

Four of the non-users of *Shatabdi* interviewed were found to be Marginal farmers with landholdings ranging from 0.2 to 0.82 ha and, considering the family sizes, their RSSIs ranged from 38 to 91%. All four farmers reported that their yields of the old wheat variety, *Kanchan,* were at least 2,000 kg/ha, see Table 1. However, this variety was said to have a sterility problem and all the farmers were keen to switch to *Shatabdi* but had been unable to obtain seed. Heavy rainfall at harvest time and weeds were also said to be major constraints to wheat production. Only one of the Marginal farmers reported being regularly visited by extension.

*Subsistence farmers*

Two Subsistence farmers were supporting, in one case three adults and three children and in the other, five adults only on 0.82 and 1.37 ha of land respectively. These farming families had RSSIs of 121 and 182% respectively. The poorer farmer had managed to produce a yield of 2,300 kg/ha for *Kanchan,* while the richer farmer's yield was just 1,580 kg/ha, see Table 1. Wheat sterility was said to be a problem by one of the farmers and heavy rainfall at harvest time and weeds were mentioned as major constraints. Both farmers complained of lack of *Shatabdi* seed.

*Food Surplus farmers*

These three farmers had an average landholding of 1.52 ha supporting an average family of three adults and two children. As a result they each enjoyed an RSSI of more than 200%. Two of these farmers complained of wheat sterility and as a result, obtained a yield of 1,580 kg/ha from *Kanchan*, while the third was able to harvest 2,370 kg/ha, see Table 1. One of the farmers was "rarely" visited by extension, while the other two had not been visited at all. Seed shortage was given as the reason for not changing to *Shatabdi* and heavy rainfall at harvest time and low yield of *Kanchan* were said to be the most serious constraints to wheat production.

**Table 1:** Comparative self-sufficiency and wheat productivity of users and non-users of *Shatabdi* in Daulatpur village

USERS

| Farmer | Farmer | Religion | Family size | | | Total paddy | Land- | Rice self- | Wheat | Does | Kanchan | Shatabdi | Yield | Actual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| name | type | | Adults | Adolesc | Children | requirement | holding | sufficienc | sterility | Extensior | Yield | yield | increase | increased |
| | | | | | | (kg/yr) | (ha) | index % | | visit? | (kg/ha) | (kg/ha) | (%) | income Tk |
| R K Barmon | Marginal | Hindu | 2 | 0 | 2 | 1,096 | 0.2 | 43 | no | no | 1,200 | 2,500 | 108 | 2600 |
| T Chakrabarti | Marginal | Hindu | 3 | 0 | 3 | 1,644 | 0.61 | 88 | ? | no | 1,900 | 2,600 | 37 | 4270 |
| R Babu | Marginal | Hindu | 7 | 2 | 3 | 3,652 | 1.46 | 94 | no | no | 1,300 | 2,500 | 92 | 17520 |
| Means | | | 4 | 1 | 3 | 2,131 | 0.76 | 75 | | no | 1467 | 2533 | 79 | 8130 |
| B Chandra | Subsistence | Hindu | 2 | 2 | 1 | 1,461 | 0.64 | 103 | yes | yes | 1,000 | 3,000 | 200 | 12800 |
| D Barman | Subsistence | Hindu | 3 | 0 | 2 | 1,461 | 1.14 | 184 | no | no | 2,200 | 3,100 | 41 | 10260 |
| Means | | | 3 | 1 | 2 | 1,461 | 0.89 | 144 | | | 1600 | 3050 | 120 | 11530 |
| N M Roy | Food surplus | Hindu | 3 | 2 | 0 | 1,343 | 1.22 | 214 | no | no | 2,000 | 3,000 | 50 | 12200 |
| M R Rani | Food surplus | Hindu | 3 | 2 | 1 | 1,826 | 2.11 | 273 | no | no | 1970 | 2,500 | 27 | 11183 |
| D Miah | Food surplus | Muslim | 5 | 1 | 1 | 2,282 | 3.3 | 341 | no | yes | 1380 | 2,400 | 74 | 33660 |
| T Begom | Food surplus | Muslim | 3 | 3 | 0 | 1,917 | 2.83 | 348 | no | yes | 2570 | 3,700 | 44 | 31979 |
| Means | | | 4 | 2 | 1 | 1,842 | 2.37 | 294 | no | | 1980 | 2900 | 49 | 22256 |

NON-USERS

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A Begum | Marginal | Muslim | 2 | 2 | 0 | 1,278 | 0.2 | 37 | yes | no | 2140 | n/a | n/a | n/a |
| A Ali | Marginal | Muslim | 2 | 1 | 2 | 1,370 | 0.41 | 71 | yes | no | 2,000 | n/a | n/a | n/a |
| M Hossain | Marginal | Muslim | 2 | 1 | 2 | 1,370 | 0.44 | 76 | yes | yes | 2,000 | n/a | n/a | n/a |
| N Ruzzaman | Marginal | Muslim | 5 | 0 | 2 | 2,191 | 0.82 | 88 | no | no | 1,980 | n/a | n/a | n/a |
| Means | | | 3 | 1 | 2 | 1,552 | 0.47 | 68 | | | 2030 | n/a | n/a | n/a |
| A Khaleque | Subsistence | Muslim | 3 | 0 | 3 | 1,644 | 0.82 | 118 | yes | no | 2,300 | n/a | n/a | n/a |
| D Mohan | Subsistence | Hindu | 5 | 0 | 0 | 1,825 | 1.37 | 177 | no | no | 1580.0 | n/a | n/a | n/a |
| Means | | | 4 | 0 | 2 | 1,735 | 1.10 | 147 | | no | 1940 | n/a | n/a | n/a |
| N Islam | Food surplus | Muslim | 2 | 0 | 2 | 1,096 | 1.01 | 217 | yes | no | 1580.0 | n/a | n/a | n/a |
| A Rahman | Food surplus | Muslim | 3 | 0 | 3 | 1,644 | 1.53 | 220 | yes | no | 1,580 | n/a | n/a | n/a |
| D Ray | Food surplus | Hindu | 5 | 1 | 0 | 2,099 | 2.02 | 227 | no | rarely | 2,370 | n/a | n/a | n/a |
| Means | | | 3 | 0 | 2 | 1,613 | 1.52 | 221 | | | 1843 | n/a | n/a | n/a |

Data collected by Elahi Baksh & team. Analysed and compiled by Sam Page, CABI.

### 1.2.2 Results of interviews with farmers in Jagdal village

Again nine users and nine non-users of *Shatabdi* were interviewed in this village.

**Users of *Shatabdi***

*Marginal farmers*
Four of the nine farmers interviewed in Jagdal were identified as Marginal once their FSSIs had been calculated. These farmers had an average of three adults, three adolescents and three children under 10 years as dependents. However their landholdings ranged from 0.13 to 0.61 ha, providing an average RSSI of only 52%. These farmers had obtained an average yield of 1,953 kg/ha for *Kanchan* and managed to increase this to 3,075 kg/ha (representing an increase of 60%) once they changed to *Shatabdi*. This gave them an increased income of between Tk1,287 and Tk7,259, see Table 2. Only one farmer said he was visited regularly by extension and all farmers reported hand threshing, rainfall at harvest time and weeds as constraints to wheat production,

*Subsistence farmers*
Of the three Subsistence farming families that were interviewed in Jagdal, their average family size was four adults and one adolescent. These farmers had an average landholding of 1.18 ha providing a mean RSSI of 157%. Once these farmers had changed from growing *Kanchan* to *Shatabdi*, their wheat yields increased by between 15 and 58%, providing an increased income of at least Tk3,705. Only one of these farmers was visited by extension, while major constraints were said to be weeds and hand threshing, see Table 2.

*Food surplus farmers*
One of the Food surplus farmers interviewed had access to 1.42 ha, while the other had 7.29 ha of land. Considering their family sizes: three adults and three young children in the first case and seven adults and one young child in the second, this provided RSSIs of 210 and 647% respectively. These two farmers had obtained an average wheat yield of 2,175 kg/ha with *Kanchan* and had increased this yield by 39% with *Shatabdi*. This provided increased incomes of Tk11,218 and Tk64,881 respectively, see Table 2. Both of these farmers were visited regularly by extension workers and one mentioned weeds as a constraint to wheat production.

**Non-users of *Shatabdi***

*Marginal farmers*
Four Marginal farmers who were non-users of *Shatabdi* were interviewed in Jagdal village. These farmers had landholdings ranging from 0.35 to 0.88 ha, which considering their family sizes would give RSSIs of between 63 and 81%. The average Kanchan yield obtained by these farmers was 2,373 kg/ha (see Table 2) despite the fact that one of the farmers had been saving his seed for the past 18 years. Two of the farmers complained of wheat sterility and stated that they had not changed to *Shatabdi* because they could not access seed. Only one of them was visited by extension and all stated that threshing was their number one constraint in wheat production.

*Subsistence farmers*
Two Subsistence farming families consisted of either two or four adults, plus one adolescent and one child. The smaller family could achieve an RSSI of 100% from just 0.49 ha, while the larger family could achieve an RSSI of 141% from 1.11 ha of land. Their average Kanchan yield was 1,875 kg/ha, despite sterility problems, see Table 2. One of these farmers reported being regularly visited by his extension officer and both agreed that hand threshing was a major constraint to wheat production; rats and weeds were also mentioned as problems. Both farmers were keen to try *Shatabdi*.

**Table 2:** Comparative self-sufficiency and wheat productivity of users and non-users of *Shatabdi* in Jagdal village

USERS

| Farmer | Farmer | Religion | Family size | | | Total | Land- | Rice self- | Wheat | Does | Kanchan | Shatabdi | Yield | Actual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| name | type | | Adults | Adolesc | Children | rice requiren | holding | sufficienc | sterility | extension | Yield | yield | increase | increased |
| | | | | | | (kg/yr) | (ha) | index % | | visit? | (kg/ha) | (kg/ha) | (%) | income Tk |
| P Lochon | Marginal | Hindu | 3 | 2 | 1 | 1,826 | 0.13 | 17 | no | rarely | 2,370 | 3,360 | 42 | 1287 |
| So C Sarker | Marginal | Hindu | 3 | 0 | 2 | 1,461 | 0.27 | 44 | no | no | 2,080 | 3,700 | 78 | 4374 |
| B Hossain | Marginal | Muslim | 4 | 0 | 5 | 2,375 | 0.61 | 61 | yes | no | 1,380 | 2,570 | 86 | 7259 |
| Sh C Sharker | Marginal | Hindu | 3 | 0 | 2 | 1,461 | 0.49 | 79 | no | no | 1,980 | 2,670 | 35 | 3381 |
| Means | | | 3 | 3 | 3 | 1,781 | 0.38 | 50 | no | | 1953 | 3075 | 60 | 4075 |
| T Islam | Subsistence | Muslim | 4 | 2 | 0 | 2,008 | 0.99 | 116 | no | yes | 1,580 | 2,500 | 58 | 9108 |
| A Jalil | Subsistence | Muslim | 4 | 0 | 0 | 1,460 | 0.95 | 154 | no | no | 2,570 | 2,960 | 15 | 3705 |
| T Alam | Subsistence | Muslim | 4 | 2 | 0 | 2,008 | 1.59 | 187 | no | no | 1,980 | 2,960 | 49 | 15582 |
| Means | | | 4 | 1 | 0 | 1,825 | 1.18 | 152 | no | | 2043 | 2807 | 41 | 9465 |
| H Rashid | Food surplus | Muslim | 3 | 0 | 3 | 1,644 | 1.42 | 204 | no | yes | 1,980 | 2,770 | 40 | 11218 |
| J Uddin | Food surplus | Muslim | 7 | 0 | 1 | 2,738 | 7.29 | 628 | no | yes | 2,370 | 3,260 | 38 | 64881 |
| Means | | | 5 | 0 | 2 | 2,191 | 4.36 | 416 | no | yes | 2175 | 3015 | 39 | 38050 |

NON-USERS

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M Mantaz | Marginal | Muslim | 4 | 1 | 0 | 1,734 | 0.45 | 61 | no | no | 2,170 | n/a | n/a | n/a |
| S Hossain | Marginal | Muslim | 4 | 0 | 1 | 1,643 | 0.43 | 62 | yes | no | 2,570 | n/a | n/a | n/a |
| F Islam | Marginal | Muslim | 2 | 0 | 2 | 1,096 | 0.35 | 75 | yes | no | 2,570 | n/a | n/a | n/a |
| B Ray | Marginal | Hindu | 6 | 1 | 1 | 2,647 | 0.88 | 78 | no | yes | 2,180 | n/a | n/a | n/a |
| Means | | | 4 | 1 | 1 | 1,780 | 0.53 | 69 | | no | 2373 | n/a | n/a | n/a |
| L C Sarker | Subsistence | Hindu | 2 | 1 | 1 | 1,187 | 0.49 | 97 | yes | no | 1,380 | n/a | n/a | n/a |
| S Uddin | Subsistence | Muslim | 4 | 1 | 1 | 1,917 | 1.11 | 137 | yes | yes | 2,370 | n/a | n/a | n/a |
| Means | | | 3 | 1 | 1 | 1,552 | 0.8 | 117 | yes | | 1875 | n/a | n/a | n/a |
| A Ali | Food surplus | Muslim | 8 | 6 | 1 | 4,747 | 4.45 | 221 | no | yes | 2,760 | n/a | n/a | n/a |
| R Islam | Food surplus | Muslim | 2 | 0 | 0 | 730 | 1.62 | 524 | yes | yes | 1976 | n/a | n/a | n/a |
| M Uddin | Food surplus | Muslim | 5 | 0 | 1 | 2,008 | 6.48 | 762 | yes | yes | 1,780 | n/a | n/a | n/a |
| Means | | | 5 | 2 | 1 | 2,495 | 4.18 | 502 | | yes | 2172 | n/a | n/a | n/a |

Data collected by Elahi Baksh & team. Analysed and compiled by Sam Page, CABI.

*Food Surplus farmers*
The largest Food Surplus farming family contained eight adults, six adolescents and one child under 10 years. This family would be able to produce more than twice its rice requirement from its landholding of 4.45 ha (RSSI = 228%). The second largest family had an RSSI of 784% due its extremely large landholding of 6.48 ha. The smallest farming family in this group, consisting of just two adults, would be able to achieve an FSSI of 539% despite having only 1.62 ha of land. These farmers reported that Kanchan yielded an average of 2,172 kg/ha, even though one of the farmers complained of wheat sterility, see Table 2. All three farmers were visited regularly by extension and stated that hand threshing was the biggest constraint to wheat production.

### 1.2.3 Conclusions and recommendations

It is clear from these results that all socio-economic groups of farmers can benefit from the improved wheat variety *Shatabdi*. Overall the Subsistence and Marginal farmers benefited most, with increased yields of 81 and 70% respectively, while the Food Surplus farmers obtained an overall increase of 44%. This yield increase translates into more than Tk1,000 (USD15.80) for all farmers interviewed during this assessment, an amount that would make a significant impact on the income of a poor household in Bangladesh.

The users of *Shatabdi* had obtained their seed during a demonstration that had previously been held in their villages by WRC. The non-users had not been involved in the demonstration and 100% of these farmers said that they would prefer to grow *Shatabdi* rather than *Kanchan*. They complained that the seed was so far unavailable at the normal seed outlet, the Bangladesh Agricultural Development Corporation (BADC).

In order to improve the dissemination of this technology, especially amongst the poorest farmers, it is recommended that Marginal farmers are trained in the production and selling of *Shatabdi* seed. By following up those farmers who buy the seed, it will be possible to determine how far and to which socio-economic groups of farmers this improved technology has spread.

## 1.3. Impact Assessment of the Wheat Threshing Machine in Brahmanvita and Jagdal Villages

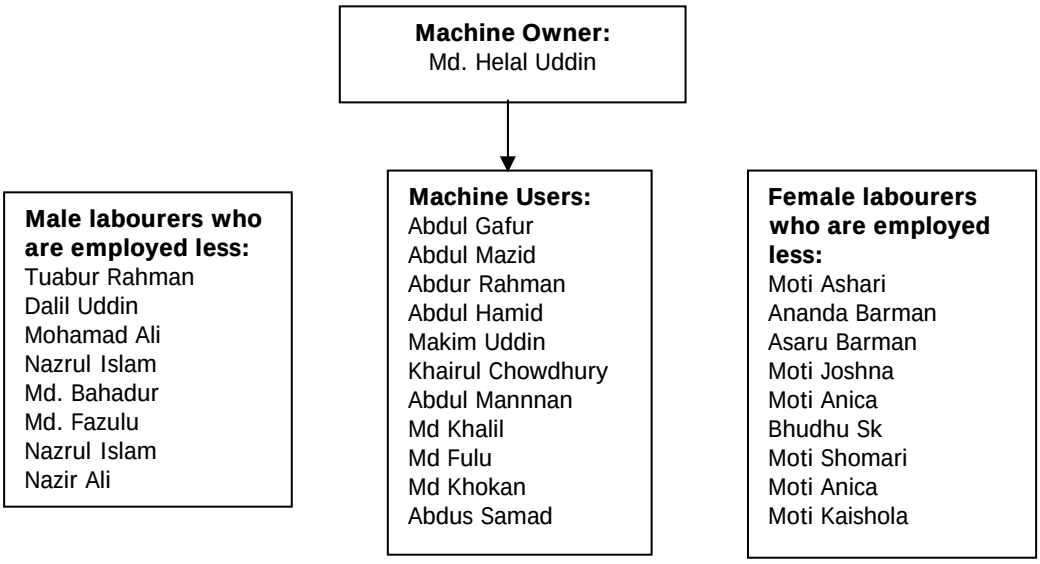
Wheat production is constrained by the drudgery associated with hand threshing the grain. Hand threshing normally employs two to three labourers for up to 10 days per tonne of wheat. Threshing machines are known to be labour saving and are thus likely to save time and remove the drudgery associated with the manual system. However, the impacts of this machine are likely to be different on each of the socio-economic farmer groups.

Several locally produced threshing machines are available and all are said to reduce drudgery and cut labour requirements. The largest of these is the "power thresher" that costs Tk39,000 (USD574). It has a closed drum and an output of 400 kg of wheat grain and chopped straw (suitable as fodder) per hour. The small, open drum thresher requires a small diesel engine to power it. This machine has an output of 150 kg of wheat grain per hour, with the straw being retained intact. Both threshing machines have the advantage of yielding 10% more and better quality, unbroken grain than is achieved through traditional hand threshing.

The wheat threshing machine that was investigated for the purposes of this study was the small open drum version. Its simple rotating drum applies just enough pressure to the wheat panicles to loosen the grain and release it onto a heap on the ground. The unbroken wheat straw can be used for thatching. This threshing machine is comparatively cheap, costing around Tk4,000 (USD59), enabling better-off farmers to purchase it directly. A six horse power diesel engine (of the type that is used to drive irrigation pumps) costing Tk9,600 (USD141) is normally used to power this small threshing machine.

Data relating to the impact of these machines were collected by conducting interviews first with the owner of the machine and then with five of the neighbouring farmers who had been hiring it. In order to determine the impact of the machine on the livelihoods of Marginal and Landless farmers/labourers, the machine users were asked to identify labourers whose services they either no longer use or now use less, see Figure 5.

***Fig. 5.*** *Access and control of a threshing machine in Brahmanvita village*




### 1.3.1 Results of interviews with farmers in Brahmanvita village

*The owner of the machine*

The threshing machine that was the centre of investigation in Brahmanvita was owned by Md Helal Uddin. Md Uddin is a Subsistence farmer with a landholding of 0.61 ha, supporting a family of two adults, one adolescent and one child, giving him an RSSI of 121%. This farmer is a trained mechanic and was able to make his own threshing machine at a cost of Tk2,000,

after seeing one being used on a neighbouring farm. He harvested 320 kg of wheat and by using the threshing machine saved 3 days, plus Tk360 in labour costs, plus an additional Tk313 for the additional grain recovered, see Table 3. By hiring the thresher out to 11 other farmers (see Figure 5.) at a rate of Tk100 per 100 decimal (0.004 ha) of harvested wheat crop, Md Uddin increased his income by Tk1,815, giving him a profit of Tk2,429 by the end of the 2004 wheat season. Md Uddin was thus able to recover the cost of his thresher within one season, see Table 3.

*The users of the machine*

All five of the randomly selected users of Md Uddin's threshing machine that were interviewed were Food Surplus farmers each having access to between 1.62 and 5.67 ha of land, with their dependents averaging three adults, one adolescent and one child and producing RSSIs of between 419 to 916%. These farmers had harvested between 440 and 3,400 kg of wheat. They had saved an average of 5 days, plus labour costs averaging Tk576. After paying fuel costs of Tk160, plus the Tk100 per 100 decimal of harvested crop hire charge to the machine owner, Md Uddin, they had been able to gain returns of between Tk198 and Tk1,840 when the additional grain recovered by the thresher was taken into account, see Table 3.

*Female labourers who are employed less because of the machine*

*Fig. 6. Farm labourers in Jagdal village*

The machine owner and users identified nine female farm labourers whose employment had been reduced since they had begun using the threshing machine, see Figure 5. Five of the female labourers were followed up and questioned about the impact of the threshing machine on their livelihoods. All five were Hindu (Muslim women rarely work outside the home). Their husbands were said to be employed either as labourers or 'van pullers' (rickshaw drivers). Most of these women were from Marginal farmer families with holdings of between 0.04 and 0.6 ha and with an average of two adult and two child dependents, suggesting RSSIs of between 17 and 36%. Most of their children were attending school. One of the labourers was a Landless widow living in rented accommodation, while another was a Subsistence farmer with 0.6 ha of land providing an RSSI of 129% for her family of two adults and two children. All these women complained of on-going food shortages.

Since the arrival of the threshing machine, the female labourers had lost an average of 4 days' work, costing Tk240, One female labourer reported having a debt of Tk1, 200. The labourers said that it was possible to find alternative work, such as weeding winter boro rice, at this time of the year (i.e. March/April). The period from mid August to mid October was said to be the most difficult time to find employment.

*Male labourers who are employed less because of the machine*

Five of the eight male labourers that were interviewed were Marginal farmers with landholdings averaging at 0.09ha. The biggest family (2 adults, 2 adolescents and 2 children) had an RSSI of just 6% while the remainder could expect to harvest between 17 and 36% of their annual rice requirement. Three of these men were Muslim, while the other two were Hindu. The Hindu men could benefit from additional income from their wives as most of them were also employed as labourers.

The male labourers had lost an average of 3.6 days' work, costing Tk208. One of the labourers admitted having a debt of Tk2,300, see Table 3. These men agreed that it was possible to find alternative work during the period when wheat is threshed.

**Table 3:** Wheat threshing machine: winners and losers in Bramanvita village

| Farmer | Religion | Farmer | Access | Land | Family size | | | Annual | Rice self- | Wheat | Time | Labour | Value of | Income | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| name | | type | to | holding | Adults | Adolesce | Children | paddy | sufficiency | yield | saved | costs | additional | from other | return from |
| | | | thresher | (ha) | | | | req. (kg) | index (%) | (kg) | (days) | saved (Taka) | grain (Taka) | users (Taka) | thresher (Tk) |
| H Uddin | Muslim | Subsistence | Owns | 0.61 | 2 | 1 | 1 | 1,187 | 121 | 320 | 3 | 360 | 313 | 1,815 | 2,429 |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | Hire + fuel charge | |
| M Rahman | Muslim | Food surplus | Hires | 1.62 | 2 | 0 | 1 | 913 | 419 | 440 | 2 | 240 | 133 | 175 | 198 |
| A Kashem | Muslim | Food surplus | Hires | 4.86 | 5 | 1 | 1 | 2,282 | 503 | 600 | 2 | 240 | 250 | 250 | 240 |
| S Islam | Muslim | Food surplus | Hires | 3.24 | 2 | 1 | 2 | 1,370 | 558 | 400 | 3 | 360 | 400 | 260 | 500 |
| A Gafur | Muslim | Food surplus | Hires | 3.24 | 3 | 1 | 0 | 1,369 | 559 | 1,000 | 5 | 600 | 600 | 375 | 825 |
| A Mozid | Muslim | Food surplus | Hires | 5.67 | 3 | 0 | 2 | 1,461 | 916 | 3,400 | 12 | 1,440 | 1,400 | 1,000 | 1840 |
| Means | | | | 3.73 | 3 | 1 | 2 | 1,479 | 591 | 1,168 | 5 | 576 | 557 | 412 | 721 |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | Labour days | Income | Debt |
| Female labourers | | | | | | | | | | | | | lost | lost (Taka) | (Taka) |
| M Ashari | Hindu | Landless | Labours | 0 | 1 | 0 | 0 | 365 | 0 | n/a | n/a | n/a | 4.5 | 270 | 0 |
| M Anika | Hindu | Marginal | Labours | 0.12 | 2 | 2 | 2 | 1,644 | 17 | n/a | n/a | n/a | 3.5 | 210 | 0 |
| M Shomari | Hindu | Marginal | Labours | 0.14 | 2 | 0 | 2 | 1,096 | 30 | n/a | n/a | n/a | 4.5 | 270 | 0 |
| M Koishola | Hindu | Marginal | Labours | 0.14 | 2 | 0 | 1 | 913 | 36 | n/a | n/a | n/a | 4 | 240 | 0 |
| J Koisala | Hindu | Subsistence | Labours | 0.6 | 2 | 0 | 2 | 1,096 | 129 | n/a | n/a | n/a | 3.5 | 210 | 1200 |
| Means | | | | 0.2 | 2 | 0 | 2 | 1,023 | 43 | n/a | n/a | n/a | 4 | 240 | 240 |
| | | | | | | | | | | | | | | | |
| Male labourers | | | | | | | | | | | | | | | |
| A Barman | Hindu | Marginal | Labours | 0.04 | 2 | 2 | 2 | 1,644 | 6 | n/a | n/a | n/a | 2.5 | 150 | 0 |
| Ali | Muslim | Marginal | Labours | 0.08 | 2 | 0 | 2 | 1,096 | 17 | n/a | n/a | n/a | 4 | 240 | 2300 |
| N Islam | Muslim | Marginal | Labours | 0.08 | 2 | 0 | 2 | 1,096 | 17 | n/a | n/a | n/a | 3.5 | 200 | 0 |
| T Rahman | Muslim | Marginal | Labours | 0.13 | 2 | 0 | 2 | 1,096 | 28 | n/a | n/a | n/a | 3.5 | 200 | 0 |
| Asaru | Hindu | Marginal | Labours | 0.12 | 2 | 0 | 0 | 730 | 39 | n/a | n/a | n/a | 4.5 | 250 | 0 |
| Means | | | | 0.09 | 2 | 0 | 2 | 1,132 | 21 | n/a | n/a | n/a | 3.6 | 208 | 460 |

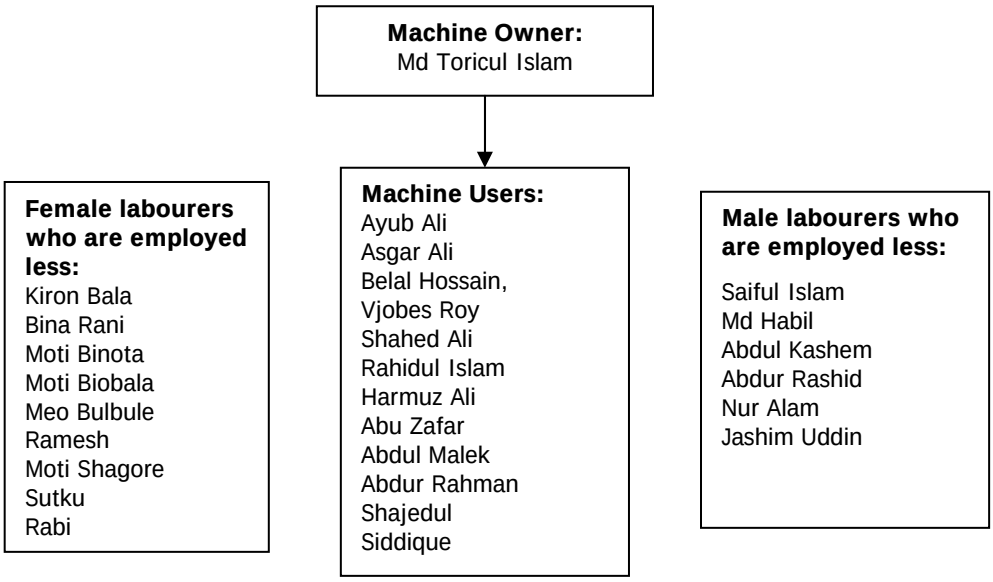
Data collected by Elahi Baksh & team. Analysed and compiled by Sam Page, CABI.

### 1.3.2 Results of interviews with farmers in Jagdal village

*The owner of the machine*

Md Toricul Islam was the owner of the threshing machine that was investigated in Jagdal village. This farmer had 4.05 ha of land, supporting six adults and one adolescent child and indicating an RSSI of 388%. Md Islam bought his machine for Tk2, 500 in 2002 and in addition to threshing his own wheat was able to hire it out to twelve other farmers (Figure 7.) at a rate of Tk100 per decimal of harvested wheat crop.

***Fig. 7.*** *Access and control of a threshing machine in Jagdal village*




*The machine users*

All five of the randomly selected farmers that hired the threshing machine were Food surplus farmers and had an average of 2.43 ha of land supporting an average household of four adults, one adolescent and one child. These families had an average RSSI of 317%. Last season they hired the machine to thresh an average of 1,040 kg of wheat, thereby saving 5 days' work each, plus an average of Tk624 in labour costs. After paying the hire charge of Tk100 per 100 decimal of harvested crop to Md Islam and the cost of diesel for the engine to power the machine, these farmers made an average, additional, overall profit of Tk779, see Table 4.

*Female labourers who are employed less because of the machine*

Three of the female labourers were Marginal farmers with approximately 0.1 ha of land, while two were completely landless. These women were all Hindu, and often worked together with their husbands. However, some of the husbands were employed in a local rice de-husking mill. These families were each supporting an average of two children. One woman who was single parent could not afford to send her adolescent child to school. All the women reported regular food shortages and three of them had debts of Tk2,000, Tk3,000 and Tk5,000. These labourers had lost an average of 3.9 labour days, worth Tk234, since the threshing machine had been introduced, see Table 4. Alternative work, i.e. weeding winter boro rice was said to be available at this time. The most difficult time to find work was said to be between 16th August and 15th October.

*Male labourers who are employed less because of the machine*

All five male labourers who were interviewed were Marginal farmers with an average of 0.1 ha of land. These men were each supporting a wife and an average of two children and also reported on-going food insecurity. Four of the men had debts ranging from Tk800 to Tk7,000. Since their employers had obtained the threshing machine they had lost an average of 2.9 days of work, valued at Tk186, see Table 4.

**Table 4:** Wheat threshing machine: winners and losers in Jagdal village

| Farmer name | Religion | Farmer type | Access to thresher | Land holding (ha) | Family size Adults | Adolesce | Children | Annual paddy req. (kg) | Rice self-sufficiency index (%) | Wheat harvest (kg) | Time saved (days) | Labour costs saved (Taka) | Value of additional grain (Taka) | Income from other users (Taka) | Total return from thresher (Tk) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T Islam | Muslim | Food surplus | Owns | 4.05 | 6 | 1 | 0 | 2,464 | 388 | 2,000 | 13 | 1,560 | 1,250 | 1,272 | 3,692 |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | Hire + fuel charge | |
| B Hossain | Muslim | Subsistence | Hires | 1.62 | 6 | 0 | 0 | 2,190 | 175 | 600 | 3 | 360 | 315 | 188 | 487 |
| S Ali | Muslim | Subsistence | Hires | 1.62 | 6 | 0 | 0 | 2,190 | 175 | 800 | 6 | 720 | 460 | 385 | 795 |
| V Roy | Hindu | Food surplus | Hires | 2.02 | 2 | 3 | 2 | 1,918 | 249 | 400 | 2 | 240 | 225 | 128 | 337 |
| Asgar Ali | Muslim | Food surplus | Hires | 2.83 | 3 | 1 | 0 | 1,369 | 488 | 1,600 | 7 | 840 | 800 | 425 | 1,215 |
| Ayub Ali | Muslim | Food surplus | Hires | 4.05 | 4 | 1 | 1 | 1,917 | 499 | 1,800 | 8 | 960 | 600 | 500 | 1060 |
| Means | | | | 2.43 | 4 | 1 | 1 | 1,917 | 317 | 1040 | 5 | 624 | 480 | 282 | 779 |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | Labour days | Income | Debt |
| Female Labourers | | | | | | | | | | | | | lost | lost (Taka) | (Taka) |
| K Bala | Hindu | Landless | Labours | 0 | 1 | 1 | 0 | 639 | 0 | n/a | n/a | n/a | 3.5 | 210 | 3000 |
| M Biobala | Hindu | Landless | Labours | 0 | 2 | 0 | 1 | 913 | 0 | n/a | n/a | n/a | 4 | 240 | 0 |
| M Binota | Hindu | Marginal | Labours | 0.08 | 2 | 2 | 2 | 1,644 | 11 | n/a | n/a | n/a | 4 | 240 | 2000 |
| M Bulbule | Hindu | Marginal | Labours | 0.1 | 2 | 0 | 1 | 913 | 26 | n/a | n/a | n/a | 4.5 | 270 | 0 |
| B Rani | Hindu | Marginal | Labours | 0.12 | 2 | 0 | 2 | 1,096 | 26 | n/a | n/a | n/a | 3.5 | 210 | 5000 |
| Means | | | | 0.06 | 2 | 1 | 1.2 | 1041 | 13 | n/a | n/a | n/a | 3.9 | 234 | 2000 |
| | | | | | | | | | | | | | | | |
| Male labourers | | | | | | | | | | | | | | | |
| A Rashid | Muslim | Marginal | Labours | 0.04 | 2 | 0 | 0 | 730 | 13 | n/a | n/a | n/a | 3.5 | 210 | 800 |
| N Alam | Muslim | Marginal | Labours | 0.08 | 2 | 1 | 2 | 1,370 | 14 | n/a | n/a | n/a | 3.5 | 210 | 0 |
| Md Habil | Muslim | Marginal | Labours | 0.1 | 2 | 0 | 1 | 913 | 26 | n/a | n/a | n/a | 2.5 | 150 | 2000 |
| A Kashem | Muslim | Marginal | Labours | 0.15 | 2 | 1 | 2 | 1,370 | 26 | n/a | n/a | n/a | 2.5 | 210 | 1000 |
| S Islam | Muslim | Marginal | Labours | 0.14 | 2 | 0 | 1 | 913 | 36 | n/a | n/a | n/a | 2.5 | 150 | 7000 |
| Means | | | | 0.10 | 2 | 0 | 2 | 1059 | 23 | n/a | n/a | n/a | 2.9 | 186 | 2160 |

Data collected by Elahi Baksh & team. Analysed and compiled by Sam Page, CABI.

### 1.3.3 Conclusions and recommendations

The impact of the small, open-drum, wheat threshing machine on the livelihoods of farmers in Brahmanvita and Jagdal villages was highly disproportionate and depended on the comparative wealth of individual farmers. At the relatively low cost of Tk2, 500, Food surplus farmers, such as Md Islam, can easily afford to purchase this machine in order to process their own wheat harvests. These farmers can also benefit from 10% more and better quality grain as a result of the mechanised threshing and are likely to make sufficiently large savings on labour and additional grain to allow them to pay off the cost of the machine after just one wheat harvest. Poorer Subsistence/self-sufficient farmers, such as Md Uddin[1] may be able to buy a small threshing machine for use as an income-generating activity. It is necessary for these farmers to have access to a motor that can power the thresher. In this case the farmer will benefit most from hiring the machine out to neighbouring farmers. The charge for this service was Tk100 per 100 decimal of wheat crop, plus an additional cost for the diesel. Our results demonstrate that the cost of the wheat threshing machine can be covered within one wheat threshing season, if the machine is hired out to 11 or more farmers. However, it may take several more seasons to recover the cost of the diesel engine.

The impact of the wheat threshing machine on Marginal and Landless farmers was found to be entirely negative. This is probably because as wheat farmers they are too poor to hire the machine, while as labourers their opportunities to find employment as hand threshers has been significantly reduced (up to 30%). In the case of the two threshing machines that were investigated for this study, the female labourers' loss of labour amounted to an average of 4 days, while for the male labourers this loss was 3 days. Fortunately, it is possible for most of these farmers/labourers to find alternative employment, because the time for wheat threshing (end of March beginning of April) happens to coincide with the time for weeding of winter boro rice. Nevertheless, the machine is having no impact on improving the livelihoods of the poorest farmers (see Figure 8): While comparatively rich Food surplus farmers are gaining, on average, Tk750 each time they use the machine to thresh their wheat, the Marginal and Landless female farmers/labourers are each losing an average of Tk237 and their male counterparts are each losing Tk197 during the wheat threshing period. All of the farmer/labourers questioned during this survey complained of food shortages, while some reported debts of up to Tk7,000, see Tables 3 & 4.

#### Making access to the threshing machine more equitable

Access to the threshing machine can only be equitable once all four socio-economic groups of farmers are able to benefit equally from its use. Despite the fact that many Marginal farmers have reported that hand threshing is a major constraint to wheat production (see Tables 1 & 2) it is evident that most of these farmers do not grow sufficient wheat to justify the current cost of having it threshed mechanically. Both Marginal and Landless farmers could, however, benefit from owning and hiring out the machine to other farmers.

In order to make access to the threshing machine more equitable, it is recommended that selected Marginal/Landless farmers be supported in their application for a loan, in order to purchase a low-cost, open-drum threshing machine and diesel engine. With the help of a short training session these farmers could establish an income-generating activity, based on the provision of a mobile threshing service to neighbouring wheat farmers. If the thresher is used throughout the harvest period it should be possible for the loan to be repaid within two years. Once these threshing machines are in the hands of Marginal/Landless farmers it will be possible to determine whether they become accessible to other Marginal farmers who produce higher yielding *Shatabdi* wheat, particularly once they become aware of the additional, better quality grain that is produced by the machine. This would create a win-win situation in which accessibility would be broadened: the better-off farmers would retain their benefits in terms of saving labour costs and improving the grain yield, while the labourer-turned-owners and users of the machines and would make financial gains, rather than lose out in the mechanisation process.

*[1] Researchers considered Md Uddin as unusual in that he is a trained mechanic and able to make his own machine. Apparently this farmer has now established an income-generating enterprise in which he makes open-drum threshers for sale.*

## *Output 2: "Agricultural knowledge systems identified in regions concerned, uptake and adoption blockages ascertained and strategies developed to overcome these and optimise pro-poor development"*

### 2.1 Identifying Agricultural Knowledge Systems

In order to determine the agricultural knowledge systems available to farming communities in the wheat growing areas of Bangladesh and to ascertain any blockages that were being experienced by farmers based on gender or socio-economic grouping, the method indicated in Box 2, below, was used in each of the project villages:

**Box 2.**

**Knowledge mapping exercise**

This exercise consists of three steps and should be conducted with three male farmers and three female farmers from each of the four socio-economic groups: Landless, Marginal, Subsistence, Food surplus. Responses should be tabulated for ease of interpretation.

**Step 1:** Ask male and female farmers from each socio-economic group to list the various sources of information available to them.

**Step 2:** Ask farmers to explain which sources of information are most accessible, and why some sources are more effective than others.

**Step 3:** Compare the sources of information given by the farmers between each socio-economic group and with the list of all possible sources of information that were collated in Step 1. Where some farmer groups make no use of sources of information on this list, then the farmers in this group should be asked if they know of this source and/or why they do not use it and to explain the perceived blockages in accessing it.

### 2.2 Results of a Knowledge Mapping Exercise

This exercise was conducted amongst 48 farmers in Jagdal and Daulatpur villages and indicated that male, Food surplus and Subsistence farmers are able to use their human, social and financial capital in order to gain access to all available sources of information. The most serious constraints to information transfer were being experienced by women from all socio-economic groups followed by Landless and Marginal farmers, see below:

#### 2.2.1 Women farmers

- Women are normally excluded from all official research and extension activities.
- At least 45% of women are illiterate.
- More sources of information are available to the wives of Landless and Marginal farmers than to the wives of Subsistence and Food surplus farmers. This was said to be because there are many NGOs working with the poorest farmers, particularly women.
- Hindu women from Marginal and Landless farming families are more likely to take part in training than women from both Food surplus and Subsistence farming families, as well as those from Muslim farming families.

#### 2.2.2 Landless and Marginal farmers

- Marginal and Landless farmers are involved in group discussions led by NGOs.

- Marginal farmers do not have time to attend farmers' field days/fairs.
- There is a higher illiteracy rate amongst Marginal and Landless farmers.
- Marginal and Landless farmers cannot afford radios or TVs.

### 2.2.3 All groups

- Information received from family, friends, and neighbours is valued most highly.
- Men are keen to be involved in group discussions but women prefer individual contact.
- Radio is not effective because it is easy to forget what has been heard.
- Posters are more effective because they are seen often.

### 2.2.4 Implications of the results of the knowledge mapping exercise

Access to information by male farmers is constrained by access to other resources such as wealth, status and the ability to take risk. This means that Food Surplus male farmers who have a great deal of social capital, due to their wealth and status, have a wide range of information sources at their disposal, while knowledge pathways for Subsistence, Marginal and Landless farmers are blocked to varying degrees, as a result of their considerably reduced levels of social and human capital. Even the mass media such as newspapers, radio and TV are inaccessible to resource-poor farmers due to their illiteracy or their need to listen in the vernacular, as well as a lack of receiving equipment. In other words those farmers who need most information to help increase productivity are being excluded from official information channels. Of most concern is the fact that low status, Marginal and Landless farmers are seldom visited by extension. This is likely to be due to political and financial pressure which demands the fast results that can only be provided by Food Surplus or Subsistence farmers who will be the first to try out new technologies.

In the case of women the converse is true: the affluent, stay-at-home wives of Food Surplus farmers have the least access to information, while women married to Marginal and Landless farmers are motivated to get information vital for their survival from wherever they can (mainly from NGOs). This urgent need for female-friendly information has only recently been recognised by the Department of Agricultural Extension (DAE). However male officers are discouraged from visiting women, partly for cultural reasons but also because it is assumed that women are not involved in agricultural work.

## 2.3. Why Work with Resource-poor Farmers?

Marginal farmers constitute the majority in Bangladesh and yet these unfortunate farmers are normally excluded from all official research and extension activities. Table 5 compares the resources and productivity between six Food Surplus and seven Marginal farmers in Daulatpur and Jagdal, according to data collected by the Bangladesh team.

**Table 5:** Comparative productivity in wheat production between Food Surplus and Marginal farmers in Daulatpur and Jagdal villages

| Available resources | Food surplus farmers | Marginal farmers |
|---|---|---|
| Landholding | 3.37 ha | 0.57 ha |
| Reading ability | Literate | Illiterate |
| Attendance at demonstrations | Frequent | Never |
| Livestock | Cattle, bullocks, buffalo, goats | None |
| Contact with extension | Frequent | Rare |
| Ownership of machinery | Power tiller and thresher | None |
| Yield of improved wheat variety | 2.95 tonne/ha | 2.75 tonne/ha |
| Total variable production costs/ha | 12,264 Taka | 11,235 Taka |
| **Gross margin/ha** | **15, 823 Taka** | **17,062 Taka** |

This table indicates that Marginal farmers can be highly productive despite having few resources when compared with their Food Surplus counterparts. Providing support for Marginal farmers in the adoption of new technologies means they can move towards self-

sufficiency and look forward to a more secure future for themselves and their families. The activities planned in Output Two of this project will involve empowering Marginal farmers to demand equal access to new technologies in order to improve their livelihoods.

Table 6 summarises the causes of the low adoption rates for improved wheat seed and threshing machines amongst all four socio-economic groups. In the case of improved seed, non-availability and lack of information was said to be the common constraint for all groups, while the cost of replacing seed is a problem for Landless and Marginal farmers. In the case of the threshing machines, Food Surplus farmers were concerned about the quality, maintenance and availability, while the other three socio-economic groups were primarily concerned about the high cost of the machine.

**Table 6:** Causes of low adoption of improved wheat seed and threshing machines

| Landless | Marginal | Self-sufficient | Food Surplus |
|---|---|---|---|
| *Improved wheat seed:* | | | |
| Not available<br>Lack of information<br>High price | Not available<br>Lack of information<br>High price | Not available<br>Lack of information | Not available<br>Lack of information |
| *Threshing machine:* | | | |
| High price<br>Not available for hire<br>Lack of information | High price<br>Lack of information | High price<br>Locally not available<br>Maintenance is difficult<br>Lack of credit | Low quality<br>Locally unavailable<br>Maintenance is difficult |

From a livelihoods perspective, neither the improved *Shatabdi* seed nor the threshing machine was having any impact in terms of human, social, physical, financial or natural capital on Marginal and Landless farmers in Daulatpur or Jagdal villages, see Figure 8.

As a result, the Principle Investigator together with the Bangladesh team compiled an Action Plan in order to improve access and control of the improved wheat technologies and optimise pro-poor development, thereby achieving the objectives demanded by Project Output 3, see Table 7.

***Fig. 8.*** *Impact of improved wheat technologies on the livelihoods of risk-prone Marginal and Landless farmers*

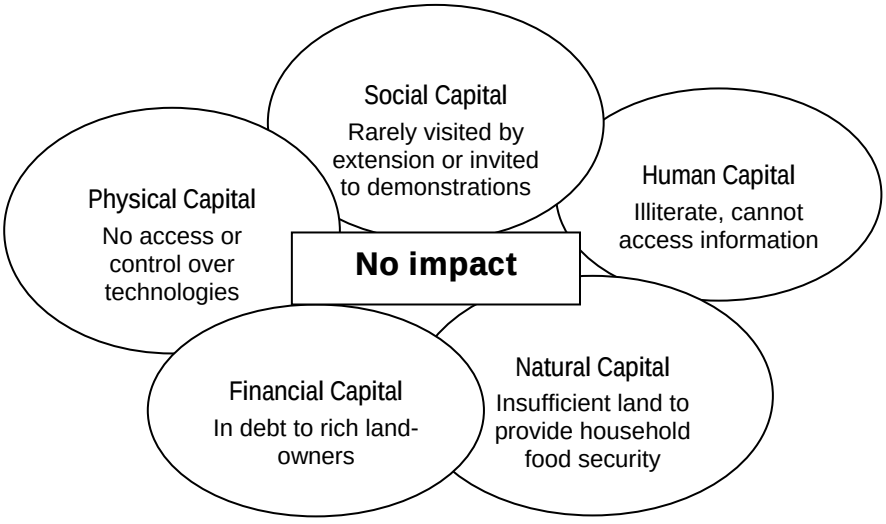


**Table 7:** Bangladesh team: action plan for Output 3

| Major activity | Sub-activities | Start date | Finish date | Outputs to unblock knowledge pathways for the poorest farmers) |
|---|---|---|---|---|
| Activity 1: **Set up a participatory wheat seed production programme for Marginal farmers** | 1. Farmer groups selection by NGO (DIPSHIKHA) | Aug 04 | Aug 04 | |
| | 2. Farming families training (10 families in each village) and 5-6 NGO workers in wheat seed production (1 day):<br>sowing plan<br>distribution of *Shatabdi* seed<br>input application (fertiliser+ irrigation) | Oct 04 | Oct 04 | Upgradating of farmers' knowledge on wheat seed production technology |
| | 3. NGO will monitor sowing activities in Nov. using calendar & planning card and supervise other activities:<br>weeding, irrigation, top dressing, rouging | Nov 04 | Mar 05 | Establishment and practical teaching of wheat seed production procedure to the resource-poor farmers |
| | 4. 2nd training for seed processing and storing<br>harvesting, threshing, cleaning, storage | Feb 05 | Mar 05 | Upgradating of farmers' knowledge about wheat seed preservation technology |
| | 5. Monitoring and data collection on amount of seed produced by each farmers, and calculation of profit (researcher/NGO will do this) | Jan 05 | Apr 05 | |
| | 6. Make a video covering all activities then distribute it to NGOs, Extn., CIMMYT and CABI | Nov 04 | Apr 05 | Booklets (pictorial) for non-literate, video and reports |
| Activity 2: **Demonstrate the ability of Marginal farmers to pay back 50% of the cost of wheat–rice thresher within 1 year.** (Machine will be provided by project.) | 7. Two Marginal farming families rent WRC thresher (8000-10000 Tk.) for one year (one in each village) | | | Solve threshing problem and increase cash earning |
| | 8. Farmers selection by NGO & scientist | Oct. 04 | Oct. 04 | |
| | 9. NGO provides business plan and keeps record of progress made on family development card | Oct. 04 | May. 05 | |
| | 10. Training will be provided by WRC in October-November for rice and in March for wheat threshing | Oct. 04 | Mar.05 | Upgradating of farmers' skills in use of threshing machines |
| | 11. Documentation of all activities by scientists (paper/article published in local newspaper, Ag. magazine, or scientific journal; brochure made and given to policy makers | Oct. 04 | May 05 | Booklets and reports |
| | 12. Record farmer's view on the success of the threshing machine on video and supply it to policy maker | Oct. 04 | May 05 | Video |
| | 13. Planning meeting with NGO (DIPSHIKHA) | June 05 | July 05 | Review past achievement; planning for future |

## *Output 3: "New technical innovations evaluated and developed by communities at pilot sites and enabling environments (including local manufacture, micro-finance, input access and training) established for participatory technology development"*

### 3.1 Creating an Enabling Environment

Information collected from farmers for Outputs 1 and 2 revealed that they had been unable to access *Shatabdi* seed from BADC, which is the main seed supplier in Bangladesh. Some farmers also complained that the quality of BADC seed was unreliable. Marginal and Landless farmers reported that they were rarely visited by extension workers and were not normally invited to attend demonstrations. In order to discover the underlying causes of these problems discussions were held with local representatives of BADC and DAE.

**Bangladesh Agricultural Development Corporation (BADC)** is a semi-autonomous corporate body under the Ministry of Agriculture, which is responsible for the procurement and supply of 'various agricultural inputs', viz, improved seeds, chemical fertilisers and irrigation equipment to the farmers. It serves the whole of Bangladesh and has a nationwide network of outlying field offices down to the upazila level and in some places even below that level. The main objective is to increase agricultural production in Bangladesh. BADC is entrusted with the task of multiplication, production and supply of high-yielding varieties of seeds and has 21 Seed Multiplication Farms and 15 Contract Growers Zones for this purpose. These seeds are mechanically processed in 12 Seed Processing Centres in and around the seed production zones before being sold to farmers.

*Fig.9. Discussions with Md E H Khan and Dr Sufian, Director, WRC*

Md Azharul Islam, Deputy Director of Seed Marketing in BADC Dinajpur explained that seed is multiplied commercially by mainly Food Surplus and Subsistence farmers selected by local block supervisors. The farmers receive basic instruction on input applications but no training in seed selection or storage. Md Islam admitted that quality control is difficult monitor, considering the numbers of farmers involved. He attributed difficulties experienced by farmers in accessing *Shatabdi* seed to shortages in both foundation seed and contract growers.

**The Department of Agricultural Extension (DAE)** is the largest public sector extension service provider in Bangladesh. It recognises agriculture as a driver of the country's development. The core function of the Department is to facilitate increases in agricultural productivity, human resource development and technology transfer. The Department has contributed significantly to crop production, especially in rice and wheat, thus helping the country to attain grain self sufficiency. Its Field Services Wing is responsible for providing an extension service to all the 17.82 million farmers in Bangladesh.

The DAE Field Services uses all methods of extension contact such as individual, group and mass. These are demonstrations, field days, district and upazila fairs, farm walks, farmers' rallies, group meetings, motivational tours, participatory technology development, formal training days, farmer field schools and individual farm visits, radio talk, folk media, newspapers and other print media and audio visual aids. The main constraints to this work are said to be:

- Shortage of field level extension workers and support staff
- Lack of opportunities for promotion and incentives for the officials and staff

- Poor accommodation and transportation facilities
- Funding constraints
- Unstable market price of agricultural produce
- Inadequate linkage between the development partners
- Lack of low cost and location specific technologies
- Wide gap between the potential and actual yields
- Inadequate gender awareness
- Degradation of the resource base
- Lack of agro-based industries

The Deputy Director of Agricultural Extension in Dinajpur, Md Ershad Hossain Khan stated that his officers are over-stretched as, in addition to normal day to day duties, they are often called upon to relay urgent government messages, assist with flood control and supervise voter registration. When asked why Marginal and Landless farmers rarely receive visits from his field officers and are largely absent from demonstrations, field days, etc., he confessed that they tend to focus on assisting Food Surplus and Subsistence farmers because of staff shortages and in the knowledge that the poorer farmers and women will be supported by local NGOs.

It was clear from our discussions that BADC is unable to provide the necessary quality control to ensure reliable production of high quality seed and will be unable to produce sufficient seed for new wheat varieties, including *Shatabdi*, to meet farmers' needs for some time to come. Furthermore, considering that Marginal and Landless farmers make up more than 70% of the farming population, it is unlikely that the poorest farmers will ever gain control of new technologies via traditional extension methods. This means that the creation of enabling environments which will allow the poorest farmers to gain access or control of new technologies, such as improved wheat seed and wheat threshing machines, will depend on collaboration between the suppliers of the improved technologies, namely WRC and a local NGO with experience of working with the poorest farmers in the Dinajpur area, namely DIPSHIKA.

*Fig. 10. Unblocking knowledge pathways: using posters to advertise Shatabdi wheat (poster designed by WRC scientist to advertise the benefits of using Shatabdi seed)*

## 3.2 Enabling the Poorest Farmers to Take Control of Improved Technologies

### 3.2.1 Enabling the poorest farmers to take control of the production and marketing of *Shatabdi* seed.

#### Farmer selection

DIPSHIKA field workers were tasked with selecting 15 Marginal or Landless farming families from each of two wheat growing districts for training in the production, storage and marketing of wheat seed, using the improved variety, *Shatabdi.* When these farming families were analysed using the RSSI (see Box 1, p. 5) it was noted that three Food Surplus and four Subsistence families were amongst those selected from Bakultala village, in Bochaganj upazila and one Food Surplus and two Subsistence families were amongst those selected from Brahmanvita village, in Birgunj upazila, see Tables 8 and 10. DIPSHIKA field workers explained that all these farmers had initially been either Marginal or Landless but some had recently benefited from one or more of their poverty alleviation programmes and as a result had apparently been able to purchase more land.

#### Whole family training in the production of high quality seed

*Fig. 11. Whole family training: child care is shared*

In order to ensure that women and men were equally involved in this process 'whole family training' was implemented. Whole family training involves the husband, wife and one or more young children. Husbands and wives are expected to sit together and alongside other participants in a way that conforms to local custom. This arrangement ensures that modesty is preserved and child care is shared during the classroom training sessions. Women are also encouraged to accompany their husbands during field work sessions. This method has been shown to improve knowledge retention significantly within the family leading to higher adoption rates of wheat technologies (Kabir, unpub.[2]) and promotes the status of women by validating their farming tasks, see Box 3.

*Fig. 12. Sleeping children at break time*

The wheat seed production training sessions were held in DIPSHIKA's village training centres at Brahmanvita and Bakultala. The first one-day whole family training session was held in November 2004 and focused on land preparation, planting and crop management, while the second session which was held in March 2005 focused on harvesting, threshing, seed selection and storage. WRC scientists prepared the

*Fig. 13. Elahi Baksh demonstrating how to rogue out off-types: a family activity*

[2] *Kabir, H. (unpub) Skilled family member(s) extension approach for rice knowledge adoption (SP # 44 02) Evaluation Report for the PETTRA project 2004.* maimun@dhaka.net

curriculum and an accompanying training manual. The training sessions were facilitated by WRC scientists and DIPSHIKA field workers. The DIPSHIKA field workers also undertook five follow-up visits, advising farmers on planting and irrigation times, as well as record-keeping and marketing, at intervals throughout the wheat growing season.

**Box 3.**

**Women's tasks in wheat production**

- Help with land preparation
- Seed planting
- Bird scaring
- Supervision of labourers
- Preparing food for labourers
- Re-distributing irrigation water to higher land
- Harvesting
- Carrying harvest to homestead
- Threshing
- Winnowing
- Seed selection and grading
- Grain drying
- Grain storage


*Fig. 14. Resource manual to accompany "whole family training" in the production, selection and storage of wheat seed*

*Fig. 15. Seed selection: women's work*

*Fig. 16. Seed storage: men's work*

## Wheat productivity following training

Following the first training session, each family was given a loan of 2 kg of *Shatabdi* wheat seed, sufficient for a 20 decimal (0.08 ha) plot, on the understanding that it would be replaced by seed selected from the harvest. Each family was responsible for the purchase of their own inputs, amounting to an average of Tk1,268 for farmers in Bakultala and Tk1,215 for farmers in Brahmanvita. Almost all the farmers had grown the old *Kanchan* variety of wheat previously, gaining average yields equivalent to 2,157 and 1,863 kg/ha in the two villages, respectively (see Tables 8 and 10). All the trained farmers increased their wheat yields per ha by more than 50% by using *Shatabdi,* with nine of the farmers actually doubling their yields, see Tables 9 and 11, while the average yield for all farmers per 20 decimal plot was 265 kg.

Some of this seed was sold as grain – an average of 39 kg in Bakultala and 52 kg in Brahmanvita, raising an immediate income of Tk418 and Tk577 respectively (see Tables 9 & 11). The carefully selected seed was then dried and stored in either air-tight (double) plastic sacks or plastic containers, at an average cost of Tk73 per farmer. In most cases the seed was stored in the bedroom for security. The farmers had been advised to wait until the following wheat planting season before selling their seed.

*Fig. 17. Mr & Mrs Lokman surveying their Shatabdi wheat crop (341 kg/0.08 plot = 4.2 tonnes/ha)*

In the meantime, the WRC scientist designed the poster shown in Figure 10 (p. 23) in order to advertise the benefits of using *Shatabdi* seed and to assist the farmers in the marketing of their seed. These posters were placed in prominent places at crossroads, market places and bus stations, in order to reach as many farmers as possible.

In the event, the price for this seed was unexpectedly high, at between Tk25 and Tk30 per kg (with one farmer, Chandra Chanta, obtaining Tk40/kg for his seed) see Table 8. When the production costs were subtracted from each farmers' income, the return from the seed selling enterprise ranged from a loss of Tk288 (USD4.24) for a Landless farmer in Brahmanvita village who chose to save most of the seed that he had produced for his own use, to a profit of Tk5,817 (USD85.5) made by Anil Chandra, a Landless farmer who produced the *Shatabdi* seed on leased land in Bakultala village (see Table 9). The average profit made by farmers in Bakultala from selling *Shatabdi* seed was Tk3,134 (USD46.1) while farmers in Brahmanvita village made a profit of Tk2,870 (USD42.2). In total these mainly Marginal farmers sold a total of 4.2 tonnes of high quality seed, which was bought by 20 Food Surplus, 24 Subsistence and 15 Marginal farmers in Bakultala and 5 Food Surplus, 37 Subsistence and 30 Marginal farmers in Brahmanvita.

*Fig. 18. The farmer stores her precious Shatabdi seed in the bedroom*

Several of the seed producers have since been visited by representatives from BADC and requests were made for them to supply *Shatabdi* seed to them on a regular basis. Some farmers reported that they were reluctant to do this as they feared that they could be exploited in terms of the price paid and risked being associated with the 'poor quality' label that is often attached to BADC seed.

### Impact of marketing *Shatabdi* seed on the livelihoods of the poorest farmers

The profits made by the sales of *Shatabdi* wheat seed made a considerable impact on the livelihoods of all farmers that had been involved in the whole family training process: Almost all invested some of their profit into agricultural inputs for the following season's crops and household items (including saris). In addition the poorest farmers had been able to pay off debts (including several who had bought threshing machines – see following section). Many farmers used the income to pay for school fees, medicine and hospital treatment. Additional capital expenditures included livestock, land, tree saplings, bicycles, tin roofs and water pumps; see Tables 9 and 11 and Figure 23.

*Fig. 19. Joynal Abedin and his wife showing off their air-tight container, filled to the brim with Shatabdi seed*

**Table 8:** Comparative rice self-sufficiency indices (RSSIs) and wheat yields for farmers in Bakultala, Bochaganj upazila

| Farmer Name | Gender | Religion | Socio-econ group | Family size | | | Landholding | | Paddy yield kg/ha | Total paddy requirement kg | RSSI % | Previous variety | Yield kg/ha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | <10yrs | 10-18yrs | >18yrs | Owned | Leased | | | | | |
| Atindra | Male | Hindu | Food surplus | 2 | 1 | 2 | 1.98 | 0 | 4,446 | 1,370 | 643 | Kanchan | 2,100 |
| Chandra Chanta | Male | Hindu | Food surplus | 0 | 2 | 2 | 1.22 | 0.40 | 3,952 | 1,278 | 377 | Gaurab | 1,721 |
| Sudhir Chandra | Male | Hindu | Food surplus | 0 | 2 | 4 | 1.58 | 0 | 4,150 | 2,008 | 327 | Kanchan | 3,000 |
| | | | | | | | | | | | | | |
| Gajen | Male | Hindu | Subsistence | 0 | 2 | 4 | 1.06 | 0 | 3,557 | 2,008 | 187 | Kanchan | 2,642 |
| Gopal | Male | Hindu | Subsistence | 2 | 0 | 3 | 0.59 | 0.20 | 4,446 | 1,461 | 180 | Kanchan | 2,600 |
| Tarini Chandra | Male | Hindu | Subsistence | 0 | 3 | 2 | 0.79 | 0.26 | 3,211 | 1,552 | 164 | Kanchan | 1,818 |
| Mala Rani | Female | Hindu | Subsistence | 1 | 1 | 3 | 0.53 | 0 | 2,964 | 1,552 | 101 | Kanchan | 2,769 |
| | | | | | | | | | | | | | |
| Anju Ara | Female | Muslim | Marginal | 1 | 1 | 2 | 0.40 | 0.79 | 3,458 | 1,461 | 95 | Kanchan | 3,000 |
| Shopen | Male | Hindu | Marginal | 2 | 1 | 2 | 0.40 | 0.26 | 2,400 | 1,370 | 70 | Kanchan | 2,400 |
| Kamini | Male | Hindu | Marginal | 0 | 0 | 5 | 0.40 | 0.33 | 2,692 | 1,825 | 58 | Kanchan | 1,739 |
| Hari Mohan | Male | Hindu | Marginal | 1 | 0 | 2 | 0.13 | 0.13 | 2,964 | 913 | 43 | Kanchan | 2,770 |
| Krisna | Male | Hindu | Marginal | 1 | 1 | 2 | 0.13 | 0.40 | 3,568 | 1,187 | 40 | Kanchan | 2,100 |
| Bimal Chandra | Male | Hindu | Marginal | 0 | 2 | 3 | 0.40 | 1.32 | 1,186 | 1,643 | 29 | Kanchan | 1,200 |
| Poresh Chandra | Male | Hindu | Marginal | 3 | 0 | 2 | 0.10 | 0.66 | 2,371 | 1,279 | 18 | Kanchan | 1,261 |
| | | | | | | | | | | | | | |
| Anil Chandra | Male | Hindu | Landless | 0 | 1 | 3 | 0 | 0.40 | 988 | 1,369 | 0 | Kanchan | 1,231 |
| Total | | | | 13 | 17 | 41 | 9.70 | 5.15 | 46,353 | 22,276 | 2331 | | 32,351 |
| Average | | | | 0.9 | 1.1 | 2.7 | 0.65 | 0.34 | 3,090 | 1,485 | 155 | | 2,157 |

Data collected by Elahi Baksh & team. Analysed and compiled by Sam Page, CABI.

**Table 9:** Impacts of producing, storing and selling *Shatabdi* seed for farmers in Bakultala, Bochaganj upazila

| Farmer Name | *Shatabdi* kg/plot | Equivalent kg/ha | Prod & storage cost/plot | Grain sold kg | Income from grain Tk | Seed own use kg | Seed sold kg | Selling price /kg | Income from seed Tk | Total income Tk | Profit/ loss Tk | Profit/ loss US$ | Customers | | | New assets bought with profit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Food surplus | Subsist | Marg | |
| Atindra | 286 | 3,532 | 1,417 | 46 | 506 | 120 | 120 | 28 | 3,360 | 3,866 | 2,449 | 36.0 | 2 | 0 | 0 | Sch. fees |
| Chandra Chanta | 242 | 2,989 | 1,208 | 32 | 352 | 120 | 90 | 40 | 3,600 | 3,952 | 2,744 | 40.4 | 4 | 0 | 0 | Sch. fees, med. |
| Sudhir Chandra | 264 | 3,260 | 1,311 | 44 | 484 | 200 | 20 | 28 | 560 | 1,044 | - 267 | -3.9 | 0 | 1 | 0 | |
| | | | | | | | | | | | | | | | | |
| Gajen | 245 | 3,029 | 1,223 | 35 | 388 | 100 | 110 | 27 | 2,970 | 3,358 | 2,135 | 31.4 | 1 | 0 | 0 | Sch. fees, repay loan |
| Gopal | 317 | 3,912 | 1,572 | 37 | 405 | 11 | 269 | 25 | 6,725 | 7,130 | 5,558 | 81.7 | 3 | 4 | 3 | Med. |
| Tarini Chandra | 315 | 3,885 | 1,562 | 45 | 491 | 200 | 70 | 28 | 1,960 | 2,451 | 889 | 13.1 | 0 | 2 | 2 | Sch.l fees, med. |
| Mala Rani | 264 | 3,260 | 1,311 | 44 | 484 | 50 | 170 | 25 | 4,250 | 4,734 | 3,423 | 50.3 | 2 | 1 | 0 | Sch. fees, repay loan, land |
| | | | | | | | | | | | | | | | | |
| Anju Ara | 264 | 3,260 | 1,311 | 34 | 374 | 40 | 190 | 30 | 5,700 | 6,074 | 4,763 | 70.0 | 1 | 1 | 0 | milking cow |
| Shopen | 264 | 3,260 | 1,311 | 44 | 484 | 75 | 145 | 26 | 3,770 | 4,254 | 2,943 | 43.3 | 3 | 0 | 0 | Sch. fees, leased land, calf |
| Kamini | 264 | 3,260 | 1,313 | 24 | 264 | 80 | 160 | 26 | 4,160 | 4,424 | 3,111 | 45.8 | 0 | 4 | 2 | Med., repay loan |
| Hari Mohan | 242 | 2,989 | 1,206 | 42 | 462 | 32 | 168 | 25 | 4,200 | 4,662 | 3,456 | 50.8 | 0 | 4 | 4 | Hosp treatment, med., repay loan |
| Krisna | 237 | 2,921 | 1,180 | 37 | 407 | 50 | 150 | 25 | 3,750 | 4,157 | 2,977 | 43.8 | 1 | 2 | 1 | Sch. fees, med., tin roof |
| Bimal Chandra | 264 | 3,260 | 1,311 | 34 | 374 | 60 | 170 | 26 | 4,420 | 4,794 | 3,483 | 51.2 | 2 | 1 | 1 | Med., repay loan, tin roof |
| Poresh Chandra | 270 | 3,328 | 1,337 | 40 | 440 | 60 | 170 | 26 | 4,420 | 4,860 | 3,523 | 51.8 | 0 | 2 | 2 | Repay loan |
| | | | | | | | | | | | | | | | | |
| Anil Chandra | 303 | 3,736 | 1,493 | 70 | 770 | 15 | 218 | 30 | 6,540 | 7,310 | 5,817 | 85.5 | 1 | 2 | 0 | Med. treatment, repay loan |
| Total | 4,039 | 49,884 | 20,066 | 632 | 6,685 | 1,213 | 2,220 | | 60,385 | 67,070 | 47,004 | 691.2 | 20 | 24 | 15 | |
| Average | 269 | 3,326 | 1,338 | 39 | 418 | 81 | 148 | 28 | 4,026 | 4,471 | 3,134 | 46.1 | 1.3 | 1.6 | 1.0 | |

Data collected by Elahi Baksh & team. Analysed and compiled by Sam Page, CABI.

**Table 10:** Comparative rice self-sufficiency indices (RSSIs) and wheat yields for farmers in Brahmanvita, Birgunj upazila

| Farmer Name | Gender | Religion | Socio-econ group | Family size | | | Landholding | | Paddy yield kg/ha | Total paddy requirement kg | RSSI % | Previous variety | Yield kg/ha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | <10yrs | 10-18yrs | >18yrs | Owned | Leased | | | | | |
| Nasima Begom | Female | Muslim | Food surplus | 2 | 0 | 3 | 2.6 | 0 | 2,674 | 1,461 | 476 | Kanchan | 1,980 |
| | | | | | | | | | | | | | |
| Arshadul Islam | Male | Muslim | Subsistence | 1 | 0 | 3 | 0.7 | 0 | 3,293 | 1,278 | 180 | Kanchan | 2,108 |
| Safar Ali Mondal | Male | Muslim | Subsistence | 1 | 0 | 2 | 0.25 | 0.2 | 4,940 | 913 | 134 | n/a | n/a |
| Azman Ali | Male | Muslim | Subsistence | 2 | 0 | 2 | 0.7 | 0 | 2,000 | 1,096 | 128 | Kanchan | 2,286 |
| | | | | | | | | | | | | | |
| Lokman Ali | Male | Muslim | Marginal | 1 | 2 | 2 | 0.6 | 0.4 | 1,976 | 1,461 | 81 | Kanchan | 2,470 |
| Ruhul Amin | Male | Muslim | Marginal | 2 | 0 | 2 | 0.2 | 0.2 | 3,425 | 1,096 | 63 | Kanchan | 1,976 |
| Azhar Ali | Male | Muslim | Marginal | 1 | 3 | 2 | 0.5 | 0 | 1,976 | 1,735 | 57 | Kanchan | 2,600 |
| Joynal Abedin | Male | Muslim | Marginal | 2 | 0 | 2 | 0.3 | 0 | 1,976 | 1,096 | 54 | Kanchan | 2,371 |
| Taibur Rahman | Male | Muslim | Marginal | 2 | 0 | 2 | 0.4 | 0.2 | 1,383 | 1,096 | 50 | Kanchan | 1,482 |
| Mominur Rahman | Male | Muslim | Marginal | 2 | 0 | 2 | 0.17 | 0.35 | 1,928 | 1,096 | 30 | Kanchan | 1,434 |
| Badsha | Male | Muslim | Marginal | 0 | 3 | 3 | 0.4 | 0.4 | 1,411 | 1,917 | 29 | Kanchan | 399 |
| Aminur Rahman | Male | Muslim | Marginal | 2 | 0 | 2 | 0.09 | 0.5 | 3,360 | 1,096 | 27 | Kanchan | 1,739 |
| Kuddus Mondal | Male | Muslim | Marginal | 3 | 0 | 2 | 0.2 | 0.4 | 1,482 | 1,279 | 23 | n/a | n/a |
| Yasin Ali | Male | Muslim | Marginal | 3 | 0 | 2 | 0.05 | 0.3 | 1,978 | 1,279 | 8 | Kanchan | 976 |
| | | | | | | | | | | | | | |
| Aynal Hoque | Male | Muslim | Landless | 2 | 0 | 2 | 0 | 0.4 | 2,240 | 1,096 | 0 | Kanchan | 2,400 |
| Total | | | | 26 | 8 | 33 | 7.16 | 3.35 | 36,042 | 18,995 | 1341 | | 24,221 |
| Average | | | | 1.7 | 0.5 | 2.2 | 0.48 | 0.22 | 2,403 | 1,266 | 89 | | 1,863 |

Data collected by Elahi Baksh & team. Analysed and compiled by Sam Page, CABI.

**Table 11:** Impacts of producing, storing and selling *Shatabdi* seed for farmers in Brahmanvita, Birgunj upazila

| Farmer Name | *Shatabdi* kg/plot | Equivalent kg/ha | Prod & storage cost/plot | Grain sold kg | Income from grain Tk | Seed own use kg | Seed sold kg | Selling price /kg | Income from seed Tk | Total income Tk | Profit/ loss Tk | Profit/ loss US$ | Customers | | | New assetts bought with profit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Food surplus | Subsist | Marg | |
| Nasima Begom | 242 | 2,989 | 1,318 | 52 | 572 | 40 | 150 | 30 | 4,500 | 5,072 | 3,754 | 55.2 | 2 | 2 | 2 | |
| | | | | | | | | | | | | | | | | |
| Arshadul Islam | 220 | 2,717 | 1,206 | 40 | 440 | 40 | 140 | 28 | 3,920 | 4,360 | 3,154 | 46.4 | 0 | 3 | 1 | Repay loan |
| Safar Ali Mondal | 231 | 2,853 | 1,263 | 41 | 451 | 100 | 90 | 30 | 2,700 | 3,151 | 1,888 | 27.8 | 0 | 1 | 1 | Repay loan, calf |
| Azman Ali | 242 | 2,989 | 1,320 | 52 | 572 | 40 | 150 | 27 | 4,050 | 4,622 | 3,302 | 48.6 | 0 | 2 | 3 | Repay loan |
| | | | | | | | | | | | | | | | | |
| Lokman Ali | 341 | 4,211 | 1,847 | 66 | 726 | 160 | 115 | 30 | 3,450 | 4,176 | 2,329 | 34.3 | 1 | 2 | 0 | Tin roof, bicycle, bullock |
| Ruhul Amin | 330 | 4,076 | 1,790 | 70 | 770 | 160 | 100 | 30 | 3,000 | 3,770 | 1,980 | 29.1 | 1 | 7 | 5 | Tin roof, repay loan |
| Azhar Ali | 231 | 2,853 | 1,263 | 46 | 506 | 40 | 145 | 27 | 3,915 | 4,421 | 3,158 | 46.4 | 0 | 2 | 1 | Repay loan |
| Joynal Abedin | 314 | 3,872 | 1,705 | 64 | 699 | 40 | 210 | 28 | 5,880 | 6,579 | 4,874 | 71.7 | 0 | 3 | 2 | Sch. fees, tin roof |
| Taibur Rahman | 264 | 3,260 | 1,434 | 64 | 704 | 40 | 160 | 28 | 4,480 | 5,184 | 3,750 | 55.1 | 0 | 2 | 3 | Tin roof |
| Mominur Rahman | 290 | 3,586 | 1,573 | 60 | 664 | 75 | 155 | 28 | 4,340 | 5,004 | 3,431 | 50.5 | 1 | 2 | 0 | Repay loan, tin roof |
| Badsha | 242 | 2,989 | 1,320 | 42 | 462 | 100 | 100 | 30 | 3,000 | 3,462 | 2,142 | 31.5 | 0 | 2 | 3 | Repay loan |
| Aminur Rahman | 220 | 2,717 | 1,206 | 40 | 440 | 95 | 85 | 30 | 2,550 | 2,990 | 1,784 | 26.2 | 0 | 2 | 1 | Calf |
| Kuddus Mondal | 209 | 2,581 | 1,149 | 39 | 429 | 25 | 145 | 30 | 4,350 | 4,779 | 3,630 | 53.4 | 0 | 2 | 3 | Goats, saplings |
| Yasin Ali | 286 | 3,532 | 1,550 | 56 | 616 | 60 | 170 | 30 | 5,100 | 5,716 | 4,166 | 61.3 | 0 | 5 | 3 | Repay loan |
| | | | | | | | | | | | | | | | | |
| Aynal Hoque | 275 | 3,396 | 1,493 | 55 | 605 | 200 | 20 | 30 | 600 | 1,205 | - 288 | - 4.24 | 0 | 0 | 2 | |
| Total | 3,937 | 48,621 | 21,437 | 787 | 8,656 | 1,215 | 1,935 | | 55,835 | 64,491 | 43,054 | 633.1 | 5 | 37 | 30 | |
| Average | 262 | 3,241 | 1,429 | 52 | 577 | 81 | 129 | 29 | 3,722 | 4,299 | 2,870 | 42.2 | 0.3 | 2.5 | 2 | |

Data collected by Elahi Baksh & team. Analysed and compiled by Sam Page, CABI.

### 3.2.2. Enabling Marginal farmers to gain control of wheat threshing machines

There are two main types of threshing machine available in Bangladesh: a large power thresher which has a closed drum and threshes wheat at a rate of 400 kg of grain per hour and a smaller open drum threshing machine which threshes wheat at a rate of 150 kg of grain per hour. The power thresher also produces chopped straw that can be used as fodder, while the open drum thresher leaves the straw intact so that it can be used either for thatching or for fodder (see Figure 21). The open drum thresher is powered by a diesel engine (see Figure 20). Both types of threshing machine used in this project had been fabricated at the lowest possible cost by a local engineering workshop (UTTARAN) according to instructions given by Dr Israil Hossain, the WRC engineer.

*Fig. 20. Ruhul Amin showing his open drum thresher and diesel engine*

In order to enable poor farmers take control of these machines, scientists from the WRC worked with DIPSHIKA to select mainly Marginal farmers who could be trained to establish income-generating activities, based on the provision of a mobile threshing service to neighbouring wheat farmers. In the event, one female Subsistence farmer plus three female and four male Marginal farmers were selected for one day's training in the use of the threshing machines. Following training, seven of these farmers were provided with loans (including 8% interest) to cover the cost of purchasing the open-drum threshing machine plus diesel engine (Tk4,000 + Tk9,600 = USD200). One female farmer was loaned only Tk4,000 to purchase a drum thresher without an engine. This farmer intended to hire out her thresher to farmers who already had access to engines. One male Subsistence farmer was given a loan sufficient to purchase a large power thresher at a cost of Tk39,000 (USD574), see Table 12.

DIPSHIKA instructed the farmers with open drum threshers to pay back their loans, in six, 3-monthly instalments of Tk2,267 (or Tk4,533 over 6 months) from the profits that they obtained from the threshing and irrigation service, within 18 months, i.e. two wheat seasons, two winter boro rice irrigation and threshing seasons and one transplanted aman rice irrigation and threshing season. Md Lokman Ali, the farmer who had purchased the power thresher (see Figure 21) was given 3 years to pay back his loan at a rate of Tk3,250 per 3 months (or Tk6,500 over 6 months), see Table 12.

The farmers with open-drum threshers charged Tk745 per ha of crop threshed (with the exception of the farmer without the engine who charged only Tk375 per ha of crop). The farmer with the power thresher charged Tk1,482 per ha of crop threshed. Most of the farmers who had purchased the engines also provided an irrigation service at a rate of Tk40-45 per hour. The eight farmers with the open drum threshing machines threshed an average of 6.3 ha of crop, or a total of 50.43 ha of crop within a 6 month period. While Md Lokman Ali threshed crops harvested from 10.12 ha within this period. The average fuel (including oil) cost during this time was approximately Tk1,903 for the diesel engines that powered the open drum threshers and Tk6,801 for the power thresher. The profit gained from threshing using the open drum threshers plus diesel engines over a 6 month period ranged from Tk1,312 to Tk6,430. The latter amount was made by Ruhul Amin who threshed crops from

*Fig. 21. Md Lokman Ali demonstrating his power thresher*

15.2 ha. The female farmer, Morzina Begom, who hired out the open drum thresher without an engine obtained a profit of Tk1,500 during this time. Md Lokman Ali made the biggest profit from threshing of Tk8,198 over the same 6 month period, see Table 13.

Farmers who were able to use their diesel engines to provide an irrigation service obtained additional income and an average profit of Tk1,568 within the first 6 months, with Khangendranath Ray obtaining the biggest profit of Tk7,107 by providing irrigation for 173 hours, see Table 13.

Unfortunately, although all the thresher owners were able to make a profit from the service that they had provided (in terms of fuel costs) only two farmers had actually raised sufficient income to repay their loans in the required time: Khangendranath Ray received a total income of Tk9,599 (almost twice the amount required for his loan repayment) for threshing 6.31 ha of crop and pumping irrigation water for 173 hours. And Ruhul Amin received a total income of Tk6,655 for threshing 15.2 ha of crop and pumping irrigation water for 6 hours. The five other farmers who had the option of providing a threshing and irrigation service are unlikely to be able repay their loans within the stipulated 18 months. For example Monoka Roy threshed only 3.1 ha of crop within 6 months, producing a profit of Tk1,312. When this is added to the profit of Tk1,215 that was obtained from 30 hours of pumping irrigation water, it amounts to only Tk2,799 which is 62% of the required loan repayment over a period of 6 months. In the event she repaid only Tk2,000 to DIPSHIKA/WRC, suggesting that it will take more than 40 months for her to repay this loan, see Table 13. Only one farmer, Abul Hossain, did not use his engine to provide an irrigation service, he gained a profit of Tk3,410 from threshing 8.06 ha of wheat, which was 75% of his required loan repayments for 6 months. Morzina Begon, who did not purchase an engine and thus had no running costs, was able to earn Tk1,500 from hiring out her machine to thresh 4 ha of wheat. As a result she was able to pay her loan instalment in time and is likely to be able to repay her loan completely within 18 months.

Md Lokman Ali is also on course to repay his loan within the required 3 years as he was able to make a profit despite being unable to provide an irrigation service.

Md Lokman Ali (who is a Subsistence farmer) has the biggest loan and is thus taking the biggest risk, while Morzina Begon (who is a Marginal farmer) has the smallest loan and is taking the smallest risk. However, both of these farmers are expected to be able to repay their loans on time. The other seven farmers who bought both open drum threshers and engines have the greatest opportunity to earn money from threshing as well as from irrigation. Unfortunately only two of these farmers, Khangendranath Ray and Ruhul Amin are likely to be able to repay their loans within the required 18 months.

Altogether, the seven Marginal and two Subsistence farmers used their machines to thresh more than 60 ha of wheat crop and pump irrigation water for 281 hours over a period of 6 months, which provided a service for 108 Food Surplus, 108 Subsistence and 39 Marginal farmers, see Tables 13 and 14.

**Table 12:** Farmers who were provided with loans to purchase a threshing machine

| Farmer | Gender | Religion | Village | Type | Family size | | | Land owned (ha) | Total paddy req (kg) | Paddy yield (kg/ha) | RSSI (%) | Thresher Type | Thresher cost (Tk) | Repayments /6 month |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | <10yrs | 10-18yrs | >18yrs | | | | | | | |
| Fatima Begum | Female | Muslim | Nagri Shagri | Subsistence | 2 | 0 | 1 | 0.3 | 731 | 3,162 | 130 | open drum +engine | 13,600 | 4,533 |
| *Lokman Ali¤* | *Male* | *Muslim* | *Moricha* | *Subsistence* | *1* | *2* | *2* | *0.6* | *1,461* | *2,964* | *122* | *power thresher* | *39,000* | *6,500* |
| | | | | | | | | | | | | | | |
| Khangendranath Ray | Male | Hindu | Rudrapur | Marginal | 0 | 3 | 6 | 0.53 | 3,012 | 4,446 | 78 | open drum +engine | 13,600 | 4,533 |
| Monoka Roy | Female | Hindu | Daoga | Marginal | 0 | 1 | 4 | 0.4 | 1,734 | 2,720 | 63 | open drum +engine | 13,600 | 4,533 |
| Ruhul Amin | Male | Muslim | Arjun Naher | Marginal | 2 | 0 | 2 | 0.2 | 1,096 | 3,425 | 63 | open drum +engine | 13,600 | 4,533 |
| *Morzina Begom** | *Female* | *Muslim* | *Madop Pur* | *Marginal* | *1* | *2* | *5* | *0.53* | *2,556* | *2,900* | *60* | *open drum* | *4,000* | *1,333* |
| Milsum Begum | Female | Muslim | Brahmanvita | Marginal | 2 | 0 | 2 | 0.08 | 1,096 | 2,370 | 17 | open drum +engine | 13,600 | 4,533 |
| Serajul Islam | Male | Muslim | Brahmanvita | Marginal | 1 | 1 | 2 | 0.2 | 1187 | 3,225 | 54 | open drum +engine | 13,600 | 4,533 |
| Abul Hossain | Male | Muslim | Nondigram | Marginal | 0 | 0 | 2 | 0.6 | 730 | 256 | 21 | open drum +engine | 13,600 | 4,533 |

¤ *Owner of a power thresher*

**Owner of an open drum thresher without an engine*

Data collected by Elahi Baksh & team. Analysed and compiled by Sam Page, CABI.

**Table 13:** Farmers' ability to repay loans following the provision of a threshing/irrigation service for 6 months

| Farmer name | Threshing service for 6 months | | | | | | Irrigation service for 6 months | | | | | Total profit Tk | Net profit after repayment Tk | Net profit US$ | Estimated repayment time in months |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Amount threshed ha | Charge Tk/ha | Fuel costs Tk/ha | Total fuel cost Tk | Income Tk | Profit Tk | Charge Tk/hr | Irrig time Hrs | Total fuel cost Tk | Income Tk | Profit Tk | | | | |
| Fatima Begum | 3.5 | 745 | 350 | 1,225 | 2,607 | 1,382 | 40 | 25 | 100 | 1,000 | 900 | 2,282 | -2,251 | -33 | 37.1 |
| *Lokman Ali¤* | *10.12* | *1,482* | *672* | *6,801* | *14,999* | *8,198* | *n/a* | *n/a* | *n/a* | *n/a* | *n/a* | *8,198* | *1,698* | *24.97* | *31.2* |
| | | | | | | | | | | | | | | | |
| Khangendranath Ray | 6.31 | 745 | 350 | 2,209 | 4,701 | 2,492 | 45 | 173 | 693 | 7,800 | 7,107 | 9,599 | 5,066 | 74.50 | 12 |
| Monoka Roy | 3.1 | 745 | 322 | 998 | 2,310 | 1,312 | 40 | 34 | 135 | 1,350 | 1,215 | 2,527 | -2,006 | -29.50 | 40.8 |
| Ruhul Amin | 15.2 | 745 | 322 | 4,894 | 11,324 | 6,430 | 40 | 6 | 25 | 250 | 225 | 6,655 | 2,122 | 31.21 | 15.6 |
| *Morzina Begom** | *4.0* | *375* | *0* | *0* | *1,500* | *1,500* | *n/a* | *n/a* | *n/a* | *n/a* | *n/a* | *1,500* | *167* | *2.46* | *24* |
| Serajul Islam | 6.71 | 745 | 322 | 2,161 | 4,999 | 2,838 | 40 | 13 | 50 | 500 | 450 | 3,288 | -1,245 | -18.31 | 22.8 |
| Abul Hossain | 8.06 | 745 | 322 | 2,595 | 6,005 | 3,410 | n/a | 0 | 0 | 0 | 0 | 3,410 | -1,123 | -16.52 | 26.4 |
| Milsum Begum | 3.55 | 745 | 322 | 1,143 | 2,645 | 1,502 | 40 | 30 | 120 | 1,200 | 1,080 | 2,582 | -1,951 | -28.69 | 40.8 |
| Total | 60.55 | | 2,982 | 22,026 | 51,090 | 29.064 | 245 | 281 | 1,123 | 12,100 | 10,977 | 40,041 | 477 | 7.02 | |
| Mean | 6.73 | | 331 | 2,447 | 5,677 | 3,229 | 40.8 | 40 | 160.5 | 1,729 | 1,568 | 4,449 | 53 | 0.78 | 27.9 |

¤ *Owner of a power thresher*

**Owner of an open drum thresher without an engine*

Data collected by Elahi Baksh & team. Analysed and compiled by Sam Page, CABI.

**Table 14:** Farmers who benefited from the threshing and irrigation service

| Thresher owner | Gender | Religion | Socio-econ Group | Farmers served by thresher | | |
|---|---|---|---|---|---|---|
| | | | | Food surplus | Subsistence | Marginal |
| Fatima Begum | Female | Muslim | Subsistence | 5 | 8 | 2 |
| Lokman Ali | Male | Muslim | Subsistence | 15 | 22 | 5 |
| | | | | | | |
| Khangendranath Ray | Male | Hindu | Marginal | 15 | 11 | 5 |
| Monoka Roy | Female | Hindu | Marginal | 8 | 6 | 3 |
| Ruhul Amin | Male | Muslim | Marginal | 32 | 20 | 10 |
| Morzina Begom | Female | Muslim | Marginal | 11 | 3 | 0 |
| Serajul Islam | Male | Muslim | Marginal | 9 | 12 | 4 |
| Abul Hossain | Male | Muslim | Marginal | 9 | 16 | 7 |
| Milsum Begum | Female | Muslim | Marginal | 4 | 10 | 3 |
| Total | | | | 108 | 108 | 39 |
| Mean | | | | 12 | 12 | 4 |

Data collected by Elahi Baksh & team. Analysed and compiled by Sam Page, CABI.

## 3.3. Conclusions and Recommendations

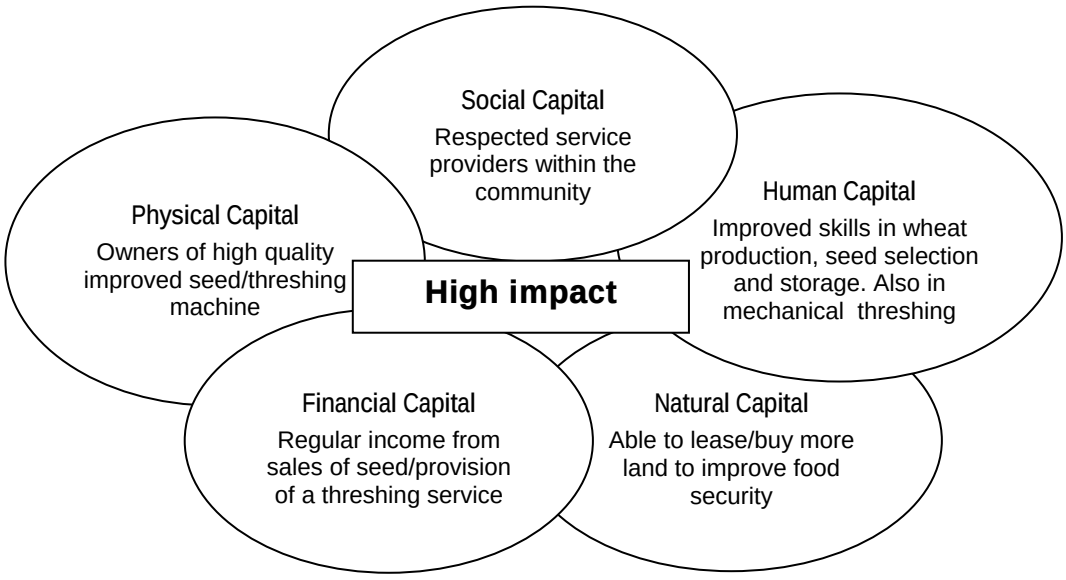
All 30 mainly Marginal farming families who participated in the whole family training in the production, selection, storage and marketing of *Shatabdi* wheat seed from 0.08 ha plots profited in terms of increased knowledge, wheat yields, high quality seed and/or financial return. These farmers were able to use this income to improve their livelihoods in terms of human capital by investing in school fees and medical expenses, social capital by gaining respect from the community as seed producers, physical capital by investing in livestock and agricultural equipment, financial capital by repaying debts and producing and marketing more seed and natural capital by leasing or buying more land to grow food crops. By enabling poor farmers gain control over the production and marketing of improved seed, a 'win-win' situation was created, in which all socio-economic groups of farmers benefited from improved access to high quality *Shatabdi* seed.

Fig. 23. *Ruhul Amin demonstrating his new hand pump*

The nine, mainly Marginal farmers who were provided with training and loans to purchase threshing machines, either with or without diesel engines, demonstrated that they could make a profit from providing a threshing service to mainly Food Surplus and Subsistence and including some Marginal farmers. This was also a 'win-win' situation, in which the poorest farmers were given control of the threshing machines and received payment from richer farmers who were grateful to use their services. As the seven thresher plus engine owners are unlikely to be able to repay the full cost of this machinery within 18 months, the repayment time should be extended to 36 months to ensure that they do not default on their loans and can gain full benefit from their enterprise.

Figure 22 shows that improved wheat technologies such as seed and machines can have a high impact on Marginal and Landless farmers when these farmers are given training and financial support.

***Fig. 22.*** *Impact of improved wheat technologies on the livelihoods of risk-prone Marginal and Landless farmers following training and financial support*



## *Final Conclusion on Assessing the Impact and Facilitating the Uptake of Resource-conserving Technologies in Bangladesh*

Although they make up more than 70% of the farming population in Bangladesh, Marginal and Landless farmers invariably miss out in the rush to adopt new RCTs which could significantly improve their livelihoods. This is because farmers that lack sufficient land to ensure household food security cannot take the necessary risks involved in changing their agricultural practises. Our analysis of this situation revealed that the poorest farmers also lack the human, social and financial capital necessary to access the information required to obtain and utilise these RCTs in a way that is beneficial. Under normal conditions these farmers are blocked from official technology transfer channels because research and extension is over-stretched and is obliged to concentrate its efforts onto richer farmers who can adopt new technologies quickly. This situation is causing increased poverty amongst Marginal and Landless farmers.

*Fig. 24. Marginal farmer giving her views at local field day*

This "Reaping the Benefits" project maximised the opportunities and options for livelihood improvement across all socio-economic groups by enabling the poorest groups, i.e. Marginal and Landless farmers (including women) to take control of two key technologies for increased wheat productivity. By providing two days of training and weekly follow-up sessions during the wheat growing season, together with a small amount of improved seed, Marginal and Landless farmers were able multiply and market this seed, thereby improving access for all socio-economic groups of farmers within the community. Similarly, by providing a few hours of training and limited financial credit, Marginal and Landless farmers were able to improve access to wheat threshing at low cost, for all wheat producers within their village. This 'bottom-up' system of technology transfer ensured that Marginal and Landless farming families gained most benefit from being in control of the new technologies, allowing them to improve their livelihoods both in actual and in comparative terms.

This 'win-win' strategy could be used to optimise the uptake of beneficial technologies to all social strata involved in agriculture across South Asia.

## Scaling up the Benefits of this Work to other Wheat-growing Areas

Following the outstanding success of this DfID-funded project, WRC held a stakeholders' workshop in April 2006, during which WRC scientists, NGO workers and alumni farmers began planning for the whole family training in wheat seed production, selection, storage and marketing plus income-generation through threshing (and winnowing) to be scaled up across all wheat growing areas of Bangladesh. This new project will involve the training of more than 10,000 Marginal/Landless farming families and the multiplication of new, improved wheat varieties, such as *Bijoy, Prodip* and *Shurub*. A cascading number of farming families will be trained with the help of workers from other local NGOs and inspired alumni farmers. The quality of this training will be maintained through the use of the WRC training manuals and a "wheat seed production" training VCD. The training VCD will be produced during the first year of the project by scientists from WRC and the Rural Development Academy[3]. This new project will be co-financed during the first year by SDC under the auspices of the Good Seed Initiative. Additional funding will be sought from other sources in order to implement the project in full.

[3] *Extension staff at the Rural Development Academy, Bogra, are renowned for their involvement in the production of the CABI "Women to Women Extension" training VCD on rice post-harvest innovations, which was funded by DfID.*

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