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Competitive Research Grant

Sub-Project Completion Report

on

Impact of Wheat Research on Adoption of Technologies, Return and Competitiveness in Bangladesh

Project Duration

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Agricultural Economics Division
Bangladesh Agricultural Research Institute
Gazipur-1701, Bangladesh

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Implementation Unit-BARC, NATP-2

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The Authors

Acronyms

AERS	:	Agricultural Economics and Rural Sociology
BADC	:	Bangladesh Agricultural Development Corporation
BARC	:	Bangladesh Agricultural Research Council
BARI	:	Bangladesh Agricultural Research Institute
BBS	:	Bangladesh Bureau of Statistics
BCR	:	Benefit cost ratio
DAE	:	Department of Agricultural Extension
DAM	:	Directorate of Agricultural Marketing
DRC	:	Domestic Resource Cost
FAO	:	Food and Agricultural Organization
FGD	:	Focus Group Discussion
GDP	:	Gross Domestic Product
GM	:	Gross margin
Ha	:	Hectare
HYV	:	High Yielding Variety
MoA	:	Ministry of Agriculture
7FYP	:	Seventh Five Years Plan
MT	:	Metric Tons
TVC	:	Total Variable Cost
TFC	:	Total Fixed Cost
NFDCC	:	National Fertilizer Distribution Coordination Committee
PSI	:	Private Sector Importers
TSP	:	Triple Super Phosphate
MOP	:	Muriate of Potash

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Executive Summary

BARI has released a good number of high yielding varieties and improved management technologies of wheat crop. The Department of Agricultural Extension (DAE) has been involved in developmental programs for the technology transfer of this crop through its countrywide networks. This impressive information indicates the immediate need of strengthening the current efforts of improved variety adoption at farm level. Although the released varieties have been found to be suitable for farmers and created additional employment, income and saved foreign exchange for the country, a large number of farmers throughout the country are still reluctant to adopt improved management technologies on wheat crop that need to be evaluated properly. Realizing the importance and demand for wheat, Bangladesh government has given emphasis on research and extension of this crop and invested a huge amount of money for attaining self-sufficiency in wheat production. Therefore, the present study has been conducted to prepare data base on the adoption of wheat technologies at farm level and to find out the factors affecting their adoptions and sustainability, to estimate the financial and economic returns and competitiveness of wheat cultivation in Bangladesh along with its impact on the livelihood of the farmers and to estimate the returns to investment (IRR, NPV, BCR) in wheat research and development in Bangladesh.

Both primary and secondary data were used in this study. Primary data were collected through household survey, while secondary data were collected from various published sources. The household survey was conducted by 7 wheat growing districts namely, Dinajpur, Rajshahi, Faridpur, Jamalpur, Tangail, Kushtia, and Madaripur for the study. The study used different statistical tools for analyzing collected data. Financial and economic profitability analysis, an *ex-post* evaluation with the help of economic surplus model under both closed and small-open market economy situations was also adopted to estimate the rate of returns (BCR, IRR & NPV) on investment in wheat in Bangladesh.

The finding of the field survey revealed that in the year 2016-17 the farmers adopted wheat varieties such as BARI Gom 21 (Shatabdi) , BARI Gom 23(Bijoy), BARI Gom 24 (Prodip), BARI Gom 25, BARI Gom 26, etc. Among those adopted varieties, BARI Gom 24 (Prodip) was highly adopted variety (32%) followed by BARI Gom 26 (30%) and BARI Gom 25 (18%), BARI Gom 21 (Shatabdi) (10%), BARI Gom 23 (Bijoy) (6%) and other occupied 4% of the total wheat areas in Bangladesh.

For economic analysis under import parity prices of wheat, the estimates of DRCs for wheat crops were observed to be less than unity implying that Bangladesh had comparative advantage in wheat production for import substitution. Due to adoption of BARI high yielding varieties over the sonalika year over year, change in consumer surplus and producer surplus were Tk 190,756/- million and Tk 65,591/- million. It is seen that consumers benefited 3.24 times higher than producer. Therefore, change in total surplus stands Tk 256,347/- million. Investment in wheat research and extension was Tk 1,5203/- million. Hence, net present value (net benefit) was found to be Tk 241,144/- million at 2016 price. Internal rate of return (IRR) was calculated 53% at current price. Benefit cost ratio (BCR) was calculated as 17 (seventeen) indicating that society (country) gained 17 times return as against the investment in wheat research and extension over the years mentioned. Therefore, the investment on R&D of wheat is found to be encouraging in Bangladesh.

CRG Sub-project Completion Report (PCR)

A. Sub-project Description

1. **Title of the CRG Sub-Project: Impact of Wheat Research on Adoption of Technologies, Return and Competitiveness in Bangladesh**

2. Implementing organization: Agricultural Economics Division, Bangladesh Agricultural Research Institute, Joydevpur, Gazipur-1701.

3. Name and address with phone, cell and E-mail of PI/Co-PI (s):

3.1 Principal Investigator (Position, full address with phone no; as applicable):

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4. Sub-project budget (Tk.):

4.1 Total: 2478440/-

4.2 Revised (if any): Not applicable

5. Duration of the sub-project:

5.1 start date (based on of LoA sign): 13 July, 2017

5.2 End date: 30 September, 2018

6. Justification of undertaking the sub-project:

Wheat is third highest growing cereals on the basis of cultivation area. Farmers of Bangladesh cultivated wheat on 4,29,607 ha of cultivated land and produced 13,02,998 mt of wheat in the year 2014 (BBS 2014). The average yield of wheat was 3.03 mt/ha. Wheat cultivation area shared 4.77% of net cropped area and 2.5% of total cropped area of Bangladesh in the year 2010-11. Irrigated wheat cultivated area covered 140307 ha of land which was 5.06% of total irrigated area of Bangladesh in the year 2010-11. The average per capita per day intake of rice was 416 gm and wheat was 26 gm. Wheat

contributes 2.6% of per capita per day total consumption of Bangladesh people. Wheat consumption was increased by 2.14 times in 2010 compared to consumption amount of the year 2005 (BBS, 2010).

Wheat grows in the sub-tropic and tropic region of Bangladesh. In that region the mean temperature during growing period (November to April) of wheat range from 18.8 ^{0}C to 25.3 ^{0}C. Prior to 1975–76, wheat was grown sporadically and was almost an unknown crop in Bangladesh (Banglapedia, 2006). Between 1970–71 and 1980–81, the cropped area under wheat jumped from 0.126 million ha to 0.591 million ha and production rose 10-fold from 0.11 million tons to 1.07 million tons, a 24.93 % annual growth rate (BARI, 2010). Even though most of the wheat varieties developed by the researcher in Bangladesh are high yielding varieties, but due to slow increase of cultivation area and production those wheat varieties did not keep pace sufficiently to match with the increasing demand for wheat created by increased population. The changing habit of cereal consumption also helped to increase demand for wheat compare to rice (WRC, 2009). In this situation, to meet the demand of an increasing population and to secure future food security, the government of Bangladesh imported more wheat between 2008 and 2011.Bangladesh is net importer of wheat and the country imported wheat 31,12,314mt in the year 2011 (FAOStat, 2014) and from the national statistical source the imported wheat was worth of Tk. 86,46,84,88,000 in the year 2010-11 (BBS, 2011). Wheat import increased with a growth rate of 11.52% per year over the period 2007-11. After the time of independence (1971), Bangladesh had become highly dependent on wheat imports while dietary preferences were changing such that wheat was becoming a highly desirable food supplement to rice. Wheat also accounted for the greatest bulk of imported food grains, exceeding 1 million tons annually and rising above 1.8 million tons in 1984, 1985 and 1987 (Index Mundi, 2012*a*). The great bulk of wheat importation is financed under aid programmes of the USA, the European Union and the World Food Programme (Index Mundi, 2012*b*). A 3-year (2008–09 to 2010–11) examination by O'Brien (2011) indicated that Bangladesh imported 3.1 million metric tons of wheat each year to meet up local requirement.

Bangladesh Agricultural Research Institute (BARI) started conducting research for developing wheat varieties after the liberation war. BARI has released good number of high yielding varieties and improved management technologies of wheat crop. The Department of Agricultural Extension (DAE) has been involved in developmental programs for the technology transfer of this crop through its countrywide networks. This impressive information indicates the immediate need of strengthening the current efforts of improved variety adoption at farm level. Although the released varieties have been found to be suitable for farmers and created additional employment, income and saved foreign exchange for the country, a large number of farmers throughout the country are still reluctant to adopt improved management technologies on wheat crop that need to be evaluated properly. Realizing the importance and demand for wheat, Bangladesh government has given emphasis on research and

extension of this crop and invested a huge amount of money for attaining self-sufficiency in the country.

Nationally representative and up-to-date data and information on the adoption and investment on research and development of wheat are lacking in Bangladesh, which will be addressed in this study. This information could be useful for both government and donor agencies in investing more on wheat improvement programs in Bangladesh.

7. Sub-project goal: Generate database on impact of wheat research on adoption of technologies, return and competitiveness in Bangladesh by using scarce resources which can be used by policy makers, researchers and extension personnel to fill up the knowledge gap in the crop sector.

8. Sub-project objective (s):

i. to prepare data base on the adoption of wheat technologies at farm level and to find out the factors affecting their adoptions and sustainability;
ii. to estimate the financial and economic returns and competitiveness of wheat cultivation in Bangladesh along with its impact on the livelihood of the farmers;
iii. to estimate the returns to investment (IRR, NPV, BCR) in wheat research and development in Bangladesh.

9. Sub-project implementation location (s)

The study was implemented in Dinajpur, Rajshahi, Faidpur, Jamalpur, Tangail, Kushtia and Madaripur districts according to the intensity both area and production.

10. Methodology in brief:

10.1 Sources of Data

Both primary and secondary data were used in the study. Primary data was related to inputs and outputs, their prices, farmers' perception on the production of wheat. All these data and information were collected from randomly selected households with the help of pre-designed questionnaire through field survey.

In order to measure the economic surpluses, rate of return on government investment, and foreign exchange savings due to cultivation of improved varieties of wheat, the following data and information were collected and analyzed.

10.1.1 Market data:

a. Retail prices of wheat- from the Directorate of Agricultural Marketing (DAM);

b. Retail prices of wheat in rural markets- from the field level or DAM;

c. Consumption statistics are essential to identify research benefits accruing to consumers and growers due to research induced price decreases. This can be imputed from

household consumption survey's (BBS) and census information on the number of household per district.

d. Supply and demand elasticities were estimated from data available in the secondary sources.

10.1.2 Technical data:

a. District level area, production and yield estimates for wheat crops- from the agricultural statistics (BBS), DAM and DAE;

b. Local level area, production, and yield estimates for wheat: from the field level cross-sectional data, BBS, DAE;

c. Research costs from technology developers: Wheat research centre, DAE, Universities, NGOs, etc.

d. Adoption profile of selected technologies: from DAE, WRC, other agencies involved in dissemination of selected technologies

11. Results and discussion: See Attachment-1 (Result and discussion are stated from Chapter I to Chapter X).

12. Research Highlights (bullet points-max.10 nos.):

- BARI has released good number of high yielding varieties and improved management technologies of wheat crop. Bangladesh government has given emphasis on research and extension of this crop and invested a huge amount of money for attaining self-sufficiency in the country.
- The finding of the field survey revealed that in the year 2016-17, BARI Gom 24 (Prodip) was highly adopted (32%) followed by BARI Gom 26 (30%), BARI Gom 25 (18%), BARI Gom 21 (Shatabdi) (10%), BARI Gom 23 (Bijoy) (6%) and others occupied 4% of the total wheat areas in Bangladesh.
- The total cost of production per hectare of different varieties was found as Akbar (Tk. 73261), BARI Gom-25 (Tk. 72590), BARI Gom-26 (Tk 70268), BARI Gom-27 (Tk 77826), BARI Gom-28 (Tk 71930), BARI Gom- 30 (Tk 76444), Bijoy (Tk 79864), Kanchon (Tk 78622), Prodip (Tk 74005), Shatabdi (Tk 78857), and Sonalika (Tk 74662) in the study areas.
- The average net return of wheat was Tk. 12490 per hectare which was the highest in Akbar (Tk. 34752) and the lowest in Bijoy (Tk. 2093) in the study areas. Average benefit cost

ratio was 1.20 which was also highest in Akbar (1.46) and the lowest in Bijoy (1.03). On an average, per kg cost of production was Tk. 20.03 which was highest in BARI Gom 25 (Tk. 22.30) followed by Bijoy (Tk. 21.15), BARI Gom 27 (Tk. 21.07), Sonalika (Tk. 20.99), BARI Gom 26 (Tk. 20.63) and Kanchan (Tk. 20.50).

- For economic analysis under import parity prices of wheat, the estimates of DRCs for wheat crops were observed to be less than unity implying that Bangladesh had comparative advantage in wheat production for import substitution.
- Due to adoption of BARI high yielding varieties over the sonalika year after year, change in consumer surplus and producer surplus were Tk 190,756 million and Tk 65,591 million. It was observed that consumers benefited 3.24 times higher than producer. Therefore, change in total surplus stands Tk 256,347 million. Investment in wheat research and extension was Tk 1,5203 million. Hence, net present value (net benefit) was found to be Tk 241,144 million at 2016 price.
- Internal rate of return (IRR) was calculated 53% at current price. Benefit cost ratio (BCR) was calculated as 17 (seventeen) indicating that society (country) gained 17 times return as against the investment in wheat research and extension. Therefore, the investment on R&D of wheat is found to be encouraging in Bangladesh.
- There are enough strengths and opportunities to invest more on R&D of wheat in Bangladesh.
- Steps should be taken to make farmers aware of improved wheat cultivation technologies in the existing cropping patterns as well as they should be aware of crop zoning for wheat to increase production.

B. Implementation Position

1. Procurement

Sl. No	Description of equipment and capital items	PP Target		Achievement		Remarks
		Phy (#)	Fin (Tk.)	Phy (#)	Fin (Tk.)	
1.	Office equipment	28	524,000	28	524,000	100%
2.	Lab and field equipment					
3.	Others capital item					

2. Establishment /renovation facilities: Not applicable

Description of facilities	Newly established		Upgraded/refurbished		Remarks
	PP Target	Achievement	PP Target	Achievement	

3. Training/Study tour/ Seminar/Workshop/Conference organized: Not organized

Description	Number of participant			Duration (Days/Weeks/Months))	Remarks
	Male	Female	Total		
(a)					
(b)					

C. Financial and physical progress

Fig in Tk

Items of expenditure/activities	Total approved budget	Fund received	Actual expenditure	Balance/ unspent	Physical progress (%)	Reasons for deviation
A. Contractual staff salary	267840	267840	261550	6290	11.12	Not duly fund released and late signing of LOA.
B. Field research/lab expenses and supplies	390000	261093	164600	96493	7.00	
C. Operating expenses	545000	507500	456393	51107	19.40	
D. Vehicle hire and fuel, oil & maintenance	561600	561000	560745	255	23.84	
E. Training/workshop/seminar etc.	100000	99525	0	99525	0.00	
F. Publications and printing	125000	106250	0	106250	0.00	
G. Miscellaneous	2500	25000	22025	2975	0.94	
H. Capital expenses	524000	524000	524000	0	22.28	
Total	2478440	2352208	1989313	362895	84.57	

D. Achievement of sub-project by objectives *(Tangible form)*:

Specific objective of the Sub-project	Major technic al activities performed in respect of the objectives	Output (i.e product obtained, visible, measurable)	Outcome (short term effect of the research)
i. To prepare data base on the adoption of wheat technologies at farm level and to find out the factors affecting their adoptions and sustainability	• Field survey • Primary data collection • Secondary data collection	• Existing situation of wheat cultivars and production technologies in Bangladesh	• Socio-economic characteristics of the farmers are important in influencing farm decision making and production planning that was found out by the study. • The household survey was conducted by 7 wheat growing districts namely, Dinajpur, Rajshahi, Faridpur, Jamalpur, Tangail, Kushtia, and Madaripur for the study. • Field survey revealed that in the year 2016-17 the farmers adopted wheat varieties such as BARI Gom 21 (Shatabdi), BARI Gom 23(Bijoy), BARI Gom 24 (Prodip), BARI Gom 25, BARI Gom 26, etc. • Among those adopted varieties, BARI Gom 24 (Prodip) was highly adopted variety (32%) followed by BARI Gom 26 (30%), BARI Gom 25 (18%), BARI Gom 21 (Shatabdi) (10%), BARI Gom 23 (Bijoy) (6%) and others occupied 4% of the total wheat areas in Bangladesh.

Specific objective of the Sub-project	Major technic al activities performed in respect of the objectives	Output (i.e product obtained, visible, measurable)	Outcome (short term effect of the research)
ii. To estimate the financial and economic returns and competitiveness of wheat cultivation in Bangladesh along with its impact on the livelihood of the farmers	• Field survey • Primary data collection • Secondary data collection	• Financial cost and return estimation • Economic cost and return estimation	• The total cost of production per hectare of different wheat varieties was found as Akbar (Tk. 73261), BARI Gom-25 (Tk. 72590), BARI Gom-26 (Tk 70268), BARI Gom-27 (Tk 77826), BARI Gom-28 (Tk 71930), BARI Gom- 30 (Tk 76444), Bijoy (Tk 79864), Kanchon (Tk 78622), Prodip (Tk 74005), Shatabdi (Tk 78857) and Sonalika (Tk 74662) in the study areas. • The average net return of wheat was Tk. 12490 per hectare which was highest in Akbar (Tk. 34752) and the lowest in Bijoy (Tk. 2093) in the study areas. Average benefit cost ratio was 1.20 which was also highest in Akbar (1.46) and the lowest in Bijoy (1.03). • For economic analysis under import parity prices of wheat, the estimates of DRCs for wheat crops were observed to be less than unity implying that Bangladesh had comparative advantage in wheat production for import substitution.

Specific objective of the Sub-project	Major technic al activities performed in respect of the objectives	Output (i.e product obtained, visible, measurable)	Outcome (short term effect of the research)
iii. to estimate the returns to investment (IRR, NPV, BCR) in wheat research and development in Bangladesh.	• Field survey • Primary data collection • Secondary data collection	• Returns to investment • Research and Development (R&D)	• The farm level yield data revealed that the adopters of improved Akbar, Kanchan, Sourav, Gourav, Shatabdi, Bijoy, Prodip, BARI Gom 25 and BARI Gom 26 received, on average, 10%, 14%, 35%, 37%, 43%, 43%, 40%, 41% and 34% respectively higher yield than that of Sonalika variety of wheat. • Net present value (net benefit) was found to be Tk 241,144 million at 2016 price. Internal rate of return (IRR) was calculated 53% at current price. Benefit cost ratio (BCR) was calculated as 17 (seventeen) indicating that the society (country) gained 17 times return as against the investment in wheat research and extension. Therefore, the investment on R&D of wheat is found to be encouraging in Bangladesh.

E. Materials development/Publications under the sub-project

Type of material/publication	Number of publication		Remarks (Paper title, name of journal, conference name, etc.)
	Under preparation	Complete published	
Technology/bulletin/booklet/leaflet/flyer etc.	✓		
Journal development	-		
Information development	-Production practices -Adoption of wheat technologies -Financial & Economic profitability -Returns to investment -Constraints to production and -Policy recommendation		
Other publication, if any			

F. Technology/Knowledge generation/Policy support (as applied)

i. Generation of technology (Commodity and Non-commodity)

ii. Generation of new knowledge that in developing more technology in future

- Adoption of improved wheat varieties at farmer's level in Bangladesh
- Comparative advantage of wheat cultivation in Bangladesh
- Impact of wheat research and development in Bangladesh

iii. Technology transferred that help increased agricultural productivity and farmers income (N/A)

iv. Policy support

- Dissemination of existing improved wheat varieties.
- Ensured available improved quality seeds.
- Strengthening existing extension services.
- Strengthening wheat research and development.
- Availability of production inputs at reasonable prices.
- Conducting regular training programme.
- Strengthening international collaboration

G. Information regarding desk and field monitoring

i) Desk monitoring [description & output of consultation meeting, monitoring, workshops/seminars etc.): Not applicable

ii) Field monitoring (Time and no of visit, Team visit and output):

Types of Audit	Major observations /issues/objections raised, if any	Status at the sub-project end	Time of visit
BARC T\team	Verified and found correct		06/02/18
GoB audit (Foreign aid)	Verified and found correct		20/10/18

I. Lesson learned (if any)

- Varietal adoption of wheat at farmer's level
- Different production technologies in wheat cultivation
- Financial and economic profitability of wheat
- Impact of wheat research and development

J. Challenges (if any)

Challenges in wheat cultivation :

- Unavailability of improved quality seeds
- Low price & low yield
- Price fluctuation
- Inadequate irrigation facility
- Low dissemination of improved technology
- Decreases wheat area due to pest and diseases infestation
- Lack of stress tolerant varieties
- Lack of knowledge about seed storage

Signature of the Coordinator/Principal Investigator (as applicable)

Date ……..

Seal

Counter signature of the Head of the agency/authorized representative

Date ……..

Seal