

Project ID 697

Competitive Research Grant

Sub-Project Completion Report

on

**Intensification of Conservation Farming in North West
Bangladesh**

Project Duration

July 2017 to September 2018

Bangladesh Rice Research Institute



Submitted to

Project Implementation Unit-BARC, NATP 2
Bangladesh Agricultural Research Council
Farmgate, Dhaka-1215



September 2018

Competitive Research Grant

Sub-Project Completion Report

on

**Intensification of Conservation Farming in North West
Bangladesh**

Project Duration

July 2017 to September 2018

Bangladesh Rice Research Institute



Submitted to
Project Implementation Unit-BARC, NATP 2
Bangladesh Agricultural Research Council
Farmgate, Dhaka-1215



September 2018

Citation

M. H. Rashid and M. R. Islam. 2018. Intensification of Conservation Farming in North West Bangladesh. A report of Competitive Research Grant Sub-Project under National Agricultural Technology Program-Phase II Project (NATP-2), Bangladesh Agricultural Research Council (BARC), Farmgate, Dhaka, Bangladesh.

Project Implementation Unit
National Agricultural Technology Program-Phase II Project (NATP-2)
Bangladesh Agricultural Research Council (BARC)
New Airport Road, Farmgate, Dhaka - 1215
Bangladesh.

Edited and Published by:

Project Implementation Unit
National Agricultural Technology Program-Phase II Project (NATP-2)
Bangladesh Agricultural Research Council (BARC)
New Airport Road, Farmgate, Dhaka – 1215
Bangladesh.

Acknowledgement

The execution of CRG sub-project has successfully been completed by BRRRI Regional Station, Rajshahi using the research grant of USAID Trust Fund and GoB through Ministry of Agriculture. We would like to thank to the World Bank for arranging the grant fund and supervising the CRGs by BARC. It is worthwhile to mention the cooperation and quick responses of PIU-BARC, NATP 2, in respect of field implementation of the sub-project in multiple sites. Preparing the project completion report required to contact a number of persons for collection of information and processing of research data. Without the help of those persons, the preparation of this document could not be made possible. All of them, who made it possible, deserve thanks. Our thanks are due to the Director PIU-BARC, NATP 2 and his team who given their whole hearted support to prepare this document. We hope this publication would be helpful to the agricultural scientists of the country for designing their future research projects in order to generate technology as well as increasing production and productivity for sustainable food and nutrition security in Bangladesh. It would also assist the policy makers of the agricultural sub-sectors for setting their future research directions.

Published in: September 2018

Printed by: Uttoron Offset Printing Press
Greater Road (West Side of City Bhaban)
Rajshahi-6000. Phone: 773782

Acronyms

BARC	Bangladesh Agricultural Research Council
BCR	Benefit Cost Ratio
BIRRI	Bangladesh Rice Research Institute
BD	Bulk Density
BP	Bed Planter
CA	Conservation Agriculture
CRG	Competitive Research Grants
DSR	Dry Seeded Rice
GM	Gross Margin
GR	Gross Return
MB	Mungbean
NATP	National Agricultural Technology Program
PTOS	Power Tiller Operated Seeder
REY	Rice Equivalent Yield
SOM	Soil Organic Matter
ST	Strip Tillage
TVC	Total Variable Cost
2-WT	Two Wheel Tractor (Power tiller)

Table of Contents

Sl. No.	Subject	Page No.
	Cover Page	i
	Citation	ii
	Acronyms	iii
	Table of Contents	iv
	Executive summary	v
01	Title of the CRG sub-project	03
02	Implementing organization	03
03	Name and full address of PI/Co-PI	03
04	Total approved cost	03
05	Duration of the sub-project	03
06	Justification of undertaking the sub-project	03-04
07	Sub-project goal	04
08	Sub-project objective (s)	04
09	Implementing location (s)	04
10	Methodology in brief:	04-07
11	Results and Discussions	08-13
12	Research highlight/findings	13
13	Procurement	14
14	Establishment/renovation facilities	15
15	Training/workshop organized	15
16	Financial and physical progress	15
17	Achievement of Sub-project by objectives	16
18	Materials Development/Publication made under the Sub-project	17
19	Technology/Knowledge generation/Policy Support (as applied):	17
20	Information regarding Desk and Field Monitoring	17
21	Lesson Learned/Challenges	18
22	Challenges	18

Executive summary

The sub-project 'Intensification of Conservation Farming in North West Bangladesh' was implemented during the period of 12 July 2017 to 30 September 2018 at the Bangladesh Rice Research Institute (BRRI), Regional Station, Rajshahi. It was a Competitive Research Grants (CRG) under the National Agricultural Technology Program- Phase II (NATP-2) with an approval budget of Taka 2,451,237.00 (Twenty-four lac fifty-one thousand and two hundred and thirty-seven). The released fund from the inception to 30 September 2018 was Tk. 2,284,398.00 (Twenty-two lacs eighty-four thousand and three hundred and eighty) and the whole amount of released fund has been utilized with this period. This project focused on the North West Bangladesh which has one of the major contributions towards national food security and livelihoods and concentrated its activities in selected places of two districts namely Rajshahi and Thakurgaon. Prior to commencement of the activities, the cropping system, natural resources and livelihood patterns of the farmers of these locations were evaluated and accordingly technological innovations were undertaken. Four conservation agriculture (CA) based trials were conducted in on-station and on-farm conditions under rice- wheat - mungbean, rice-maize-mungbean and Jute + relay Aman - wheat cropping system. In these trials, Aman rice, wheat and mungbean were grown on six farmer's field under rice-wheat-mungbean system at Thakurgaon district. Further, Aman rice, maize and mungbean were also grown under rice-maize-mungbean system at different farmers' fields of Pabaupazila of Rajshahi district. Trials on Aman rice and wheat were also executed under Jute+ relay rice-wheat cropping patterns in six farmers' fields of Rajshahi district. In case of on station trial, initial soil samples were collected prior to Aman rice, wheat and mungbean establishment under rice – wheat - mungbean cropping system. A day long training program cum field day attended by 50 farmers was arranged to demonstrate the advantages of Jute + relay rice cropping and to gear up farmers' knowledge. Another training program was also conducted at BRRI regional station with 40 participants. The yield and yield components data, inputs and outputs data of each crop were recorded. In Jute + rice relay cropping, BRRI dhan71 gave a good yield compared with conventional one. The results also showed that the transplanting of rice by rice transplanter followed by wheat and mungbean by ST/raised bed system gave higher productivity and profit margin. The bulk density, soil organic matter content, N and P was not influenced but slightly K content was increased due to 100% crop residue incorporation. The sub-project concluding workshop was arranged at BRRI, Gazipur with 80 participants where the details of the achievements were showed and important feedback were received.

CRG Sub-Project Completion Report (PCR)

A. Sub-project Description

1. **Title of the CRG sub-project:** Intensification of Conservation Farming in North West Bangladesh
2. **Implementing organization:** Bangladesh Rice Research Institute
3. **Name and full address with phone, cell and E-mail of PI/Co-PI (s):**

Principal Investigator: Dr. Md. Harun-Ar-Rashid, Senior Scientific Officer, Bangladesh Rice Research Institute, Regional Station, Rajshahi, Phone no. Off: 0721-750168, Mobile: +88-01718472403, E-mail: harunar73@yahoo.com

Co-Principal Investigator: Dr. Md. Rafiqul Islam, Chief Scientific Officer (Current Charge) & Head, Soil Science Division, BRRI, Gazipur, Mobile: +88-01725395749, E-mail: rafiqbrri@yahoo.com
4. **Budget**
 - 4.1 Total: Taka 2,451,237.00 (Twenty-four lacs fifty-one thousand two hundred and thirty-seven)
 - 4.2 Revised (if any): Taka 2,284,398.00 (Twenty-two lacs eighty-four thousand three hundred and ninety-eight (Received during this period)
 - 4.3 Utilized: Tk. 2284398.00 (Twenty-two lacs eighty-four thousand three hundred and ninety-eight)
5. **Duration of the sub-project:**
 - 5.1 Start date (based on LoA signed): 12 July 2017
 - 5.2 End date: 30 September 2018
6. **Justification of undertaking the sub-project:** This project focused on the North West Bangladesh which has one the major contribution towards national food security. The challenges in crop production now is to produce more food at less cost and to improve water, labor and land productivity. Over time, the soils of Bangladesh has become squirmy and failing to rejuvenate the nutrient supplying capacity. Exhaustive cropping system is another threat to crop productivity. One of the strategies, in this backdrop is to grow crop with the introduction of conservation farming of different nature including dry seeded rice (DSR) and the use of direct drill seeder. Conservation farming or Conservation Agriculture (CA) comprised of; a) no

or minimum soil disturbance (i.e. no/minimum tillage), b) maintenance of soil mulch cover or rational retention of crop residues and c) crop species diversification. In recent years the spread of CA has gathered even more momentum as a new paradigm for 'sustainable production intensification', and it is being considered to be a climate-smart option. Conservation farming has assumed importance in view of widespread natural resources degradation leading to increased production costs, unsustainable resource use and environmental pollution which create natural imbalance in the ecosystems. DSR and adoption of CA based practices together with utilization of mechanical seeder for crop production can be evolved as sustainable and low cost technology in north-west region of Bangladesh. Thus, in order to facilitate the sustainable crop production program using basic principles of CA (use of reduced/zero tillage, raised bed practices and rational retention of crop residues), it is of priority importance to identify the best technical know-how for the farmers and extension workers of the north-west region.

7. Sub-project goal: Contribute towards reduction of poverty in the North-West Bangladesh

8. Sub-project objective (s):

i) To assess the extent of benefits of sustainable conservation farming with respect to different cropping systems.

ii) Facilitate adoption of productive and sustainable conservation agriculture (CA) based technologies that are climate resilient and profitable for small holders.

8. Implementing location (s): Charghat, Paba and Puthia Upazila of Rajshahi district and Balia Dangi Upazila of Thakurgaon District

9. Methodology in brief: The sub-project implemented its activities in different farmer's fields of the two districts of north-west Bangladesh namely Rajshahi and Thakurgaon. Based on the principles of CA, an experiment was also set up at the BRRI Regional Station, Rajshahi. Before commencement of the activities the cropping system, natural resources and livelihood pattern of the farmers were evaluated. Four CA based trials were conducted in on-station and on-farm condition. The experiments and methodologies followed were as follows:

Expt. 1: Effects of conservation tillage with crop establishment methods and crop residue management options under Aman rice-wheat-mungbean-cropping system

Objectives

- i) To evaluate the productivity and profitability of Aman rice-wheat-mungbean cropping pattern in the context of conservation tillage and residue management options
- ii) To determine the effect of tillage and residue management option on soil properties under Aman rice-wheat-mungbean cropping pattern.

Treatments:

Factor A

- T₁. Tilling as well as seeding of Aman rice, wheat and mungbean by strip tillage (ST) system
- T₂. Tilling as well as seeding of Aman rice, wheat and mungbean by bed planting (BP) system
- T₃. Transplanting Aman rice by transplanter, tilling as well as seeding of wheat and mungbean by ST system
- T₄. Transplanting Aman rice by transplanter, tilling and seeding of wheat and mungbean by BP system
- T₅. Conventional transplanting of Aman rice through conventional tilling and seeding of wheat and mungbean (Check)

Factor B

- S₁: Retention of 30% crop residue of rice and wheat and 100% crop residue of mungbean
- S₂: Removal of crop residue of rice and wheat and retention of 100% crop residue of mungbean
- S₃: Removal of crop residue of all crops

The experiment was established in Aman season at BRRRI Regional Station, Rajshahi in Split Plot Design with 3 replications under Aman rice-wheat-mungbean-cropping system. The treatments under factor A were allocated in main plots and the treatments under factor B were allocated in sub plots.

Expt. 2: Effects of conservation tillage and crop establishment methods under Aman rice-maize-mungbean-cropping system

Objective: To evaluate the productivity and profitability of Aman rice-maize-mungbean cropping pattern in the context of conservation tillage.

Treatments:

- T₁. Tilling as well as seeding of Aman rice, maize and mungbgen by strip tillage (ST) system
- T₂. Tilling as well as seeding of Aman rice, maize and mungbgen by bed planting (BP) system
- T₃. Conventional transplanting of Aman rice by conventional tilling and seeding of maize and mungbgen (Check).

The experiment was established in Kharif-II, Rabi and Kharif-1 season at 5 dispersed farmer fields of Rajshahi district.

Expt. 3: Farmers participatory evaluation of conservation tillage and crop establishment methods under Aman rice-wheat-mungbean cropping pattern

Objectives: To evaluate the productivity and profitability of Aman rice-wheat-mungbean cropping pattern in the context of conservation tillage.

Treatments:

- T₁. Tilling as well as seeding of Aman rice, wheat and mungbgen by ST system
- T₂. Tilling as well as seeding of Aman rice, wheat and mungbgen by BP system
- T₃. Conventional transplanting of Aman rice and conventional tilling and seeding of wheat and munbgen

The experiment was established in Kharif-II, Rabi and Kharif-I season at 6 dispersed farmer fields of Thakur Gaon district.

Expt. 4: Productivity and profitability evaluation of Jute-rice-wheat cropping pattern under relay cropping with conservation tillage system

Objective: To increase the productivity and profitability of the farmers.

Treatments:

- T₁: Jute + relay BRRI dhan39-strip planted wheat
- T₂: Jute + relay BRRI dhan39-bed planted wheat
- T₃: Jute + relay BRRI dhan71-strip planted wheat
- T₄: Jute + relay BRRI dhan71–bed planted wheat
- T₅: Jute-transplanted BRRI dhan39-conventional broadcasted wheat

The experiment was established in the 6 dispersed farmers field of different places of Rajshahi district. As jute was established before commencement of the project activities, the intervention was done only in rice and wheat crops.

Data collection

Aman rice

- Number of tillers m^{-2} , number of panicles m^{-2} , grains panicle⁻¹, 1000 grain wt. and grain and straw yields (measured at maturity by agronomic means).

Wheat

- Number of spikes m^{-2} , spikelet⁻¹, thousand grain wt. and grain and straw yields (measured at maturity by agronomic means).

Maize

- Number of cobs m^{-2} , grains cob⁻¹, 1000-grain wt. and grain and straw yields (measured at maturity by agronomic means).

Mungbean

- Number of plants m^{-2} , number of pods plant⁻¹, seeds pod⁻¹, 1000 seeds wt. and grain and straw yields (measured at maturity by agronomic means).

Overall data collected

- Number of labour required during tilling as well as seeding, transplanting, weeding, pesticide, herbicide and fertilizer application operations, harvesting etc.
- Fuel consumption during tilling of soil as well as seeding of crops by machineries used.
- The price of inputs such as seeds, fertilizers, pesticides, fuel, herbicide etc. The farm gate price of the products and bi-products
- Total pattern productivity
- The initial soil sample was collected and analyzed. The final soil samples were also collected from expt. 1 for determination of bulk density and organic matter content of soil on completion of the experiment.

For interpretation of the outputs of the trials, the data were analyzed statistically through computer based statistical program crop stat. Simple economic analysis such as variable cost, gross return, gross margin and BCR were also performed.

10. Results and discussion:

Expt. 1: Effects of conservation tillage with crop establishment methods and crop residue management options under Aman rice-wheat-mungbean-cropping system

The tillage and crop establishment methods gave little effect on grain yield of rice (Fig. 1). Irrespective of residue management options, the grain yield of rice remained higher in T₃ treatment followed by T₅ and the lower grain yield was found in T₁ treatment. In contrast, the highest grain yield of wheat was found in T₁ treatment and the lowest grain yield of wheat was found in T₅ treatment which however, was statistically similar with all other treatments except T₅. In case of mungbean, the tillage treatments had no effect on grain yield.

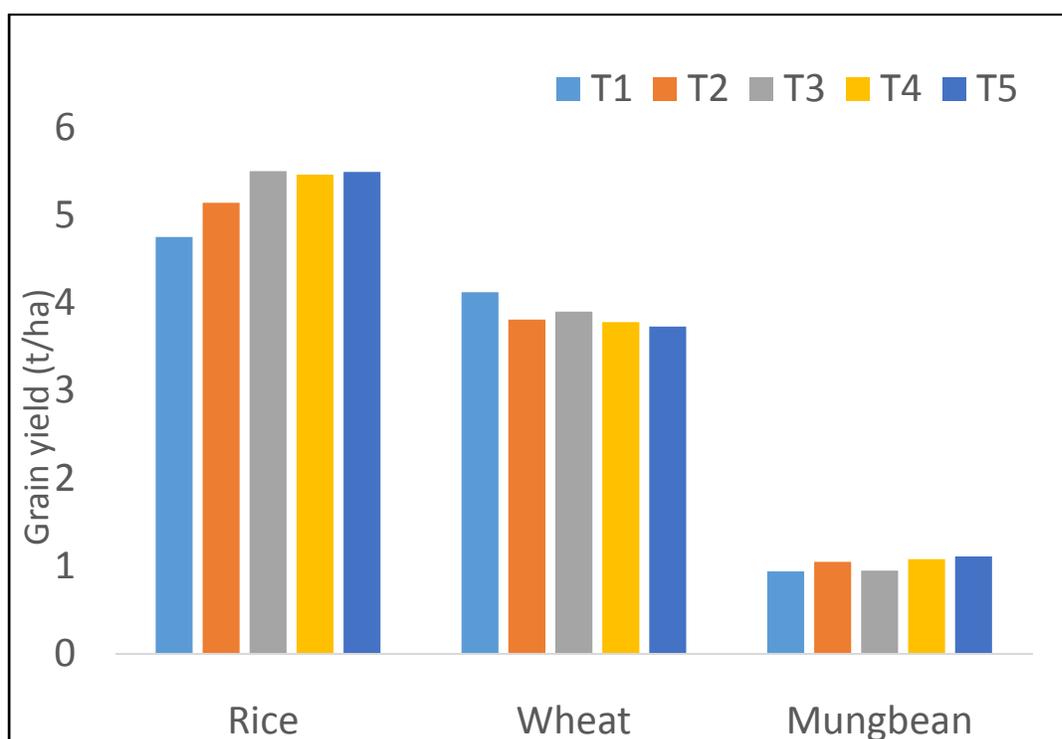


Fig.1. Effect of tillage with crop establishment methods on yields under rice-wheat-mungbean cropping systems.

T₁ : Direct seeding of rice and wheat by ST, T₂ : Direct seeding of rice and wheat by BP, T₃ : Rice by transplanter, wheat and Mungbean (MB) by ST, T₄ : Rice by transplanter, wheat and MB by BP, T₅ : Conventional rice, wheat and MB

The rice equivalent yield was found higher in T₅ which was statistically similar to all other treatments except T₁ while the variable cost was found higher in T₅ and that was remained lower in T₁ treatment (Table 1). Like rice equivalent yield, the gross return was found higher in T₅ followed by T₄ treatment. Although the higher gross return was found in T₅ treatment, the gross margin was found lower in this treatment due to higher cultivation cost. The highest gross margin was found in T₄ treatment closely followed by T₂ and T₃ treatments.

Table 1: Effect of tillage on rice equivalent yield and economies under rice-wheat-mungbean systems, 2017-18

Treatments	REY (t ha ⁻¹)	TVC (Tk.)	GR (Tk.)	GM (Tk.)
T ₁ . Direct seeding of rice and wheat by ST	12.2	132500	252200	119700
T ₂ . Direct seeding of rice and wheat by BP	12.6	136200	260300	124100
T ₃ . Rice by transplanter, wheat and MB by ST	12.7	142300	265000	122700
T ₄ . Rice by transplanter, wheat and MB by BP	13.0	144360	268500	124140
T ₅ . Conventional rice, wheat and MB	13.1	164500	269300	104800
LSD (0.05)	0.69	-	-	-

Table 2: Effect of tillage with crop establishment methods on soil properties under rice-wheat-mungbean systems, 2017-18

Treatments	BD ₋₃ (Mg m ⁻³)	SOM (%)	Total N (%)	Avai. P (µg g ⁻¹ soil)	Exch. K (meq 100 g ⁻¹ soils)
T ₁ . Direct seeding of rice and wheat by ST	1.31	1.16	0.09	9.7	0.20
T ₂ . Direct seeding of rice and wheat by BP	1.33	1.12	0.09	10.3	0.16
T ₃ . Rice by transplanter, wheat and MB by ST	1.29	1.14	0.08	10.6	0.19
T ₄ . Rice by transplanter, wheat and MB by BP	1.31	1.1	0.08	9.95	0.18
T ₅ . Conventional rice, wheat and MB	1.32	1.08	0.09	9.65	0.16
LSD (0.05)	0.03	0.14	0.02	0.85	0.03

T₁ : Direct seeding of rice and wheat by ST, T₂ : Direct seeding of rice and wheat by BP, T₃ : Rice by transplanter, wheat and Mungbean (MB) by ST, T₄ : Rice by transplanter, wheat and MB by BP, T₅ : Conventional rice, wheat and MB

The tillage treatments did not produce significant effect on bulk density (BD), soil organic matter (SOM), N and P content of soil (Table 2). The little effect of K content of soil was observed due to tillage options and that was found higher in T₁ and lower in T₂ and T₅ treatments. Like tillage, the residue management did not show significant effect on bulk density, SOM, N and P content of soil while the significantly higher K content was found in S₁ treatment compared with S₃ treatment (Table 3).

Table 3: Effect of tillage with crop establishment methods on soil properties under rice-wheat-mungbean systems, 2017-18

Treatments	BD ⁻³ (Mg m)	SOM (%)	Total N (%)	Avai. P (µg g ⁻¹ soil)	Exch. K (meq 100 g ⁻¹ soils)
S1: Retention of 30% residue of rice and wheat and 100% of mungbean	1.29	1.14	0.09	10.3	0.2
S2: Removal of residue of rice and wheat and retention of 100% of MB	1.32	1.13	0.09	9.95	0.18
S3: Removal of residue of all crops	1.32	1.09	0.08	9.87	0.16
LSD (0.05)	0.03	0.11	0.02	0.69	0.03

S₁: Retention of 30% crop residue of rice and wheat and 100% crop residue of mungbean, S₂: Removal of crop residue of rice and wheat and retention of 100% crop residue of mungbean, S₃: Removal of crop residue of all crops

Expt. 2: Effects of conservation tillage and crop establishment methods under Aman rice-maize-mungbean-cropping system

The tillage and crop establishment treatments did not produce significant influence on grain yield of rice but the conventional transplanting of Aman rice (BRRI dhan71) gave better yield compared to other two treatments (Table4). In contrast, the grain yield of maize was higher in strip tillage (T₁) system followed by bed planting system. Significantly lower maize yield was found in conventional tillage treatment while there was similar mungbean yield among the treatments. Although the treatments did not produce significant effect on rice equivalent yield but the gross margin was considerably higher in strip tillage (18%) system followed by bed planting (16%) due to reduced cultivation cost.

Table 4: Effects of conservation tillage and crop establishment methods on Aman rice under Aman rice-maize-mungbean-cropping system, 2017-18

Treatments	Yield (t/ha)			REY	TVC	GR	GM
	Rice	Maize	Mungbean	(t/ha)	(Tk./ha)	(Tk./ha)	(Tk./ha)
T ₁ . Tilling as well as seeding of Aman rice by strip tillage (ST) system	4.66	10.65	0.76	16.9	171300	338100	166800
T ₂ . Tilling as well as seeding of Aman rice by bed planting (BP) system	4.55	10.42	0.83	16.8	174700	336660	161960
T ₃ . Conventional transplanting of Aman rice	5.03	9.66	0.86	16.7	193600	334680	141080
LSD (0.05)	NS	0.72	NS	NS	-	-	-

Expt. 3: Farmers participatory evaluation of conservation tillage and crop establishment methods under Aman rice-wheat-mungbean cropping pattern

The grain yield of BRR1 dhan71 was affected significantly by the tillage and crop establishment treatments. The grain yield remained higher (5.71 t/ha) in conventional transplanting of Aman rice (Table 5) followed by Bed planting system while the significantly lower grain yield was produced in strip tillage system (5.12 t/ha). The grain yields of wheat and mungbean were not affected due to tillage options. Though rice equivalent yield found higher in conventional tillage, the gross margin remained higher in strip tillage and bed planting options due to lower cultivation cost.

Table 5: Effects of conservation tillage and crop establishment methods on Aman rice, wheat and mungbean under Aman rice-wheat-mungbean-cropping system, 2017-18

Treatments	Yield (t ha ⁻¹)			REY	TVC	GR	GM (Tk. ha ⁻¹)
	Rice	Wheat	Mungbean	(t ha ⁻¹)	(t ha ⁻¹)	(Tk. ha ⁻¹)	(Tk. ha ⁻¹)
T ₁ . Tilling as well as seeding of Aman rice by strip/bed tillage (ST) system	5.12	3.79	0.85	11.9	135800	249700	113900
T ₂ . Tilling as well as seeding of Aman rice by strip/bed planting (BP) system	5.41	3.68	0.91	12.3	141200	256500	115300
T ₃ . Conventionally transplanting Aman rice	5.71	3.62	1.03	12.9	163400	268000	104600
LSD (0.05)	0.49	NS	NS	0.69	-	-	-

Expt. 4: Productivity and profitability evaluation of Jute-rice-wheat cropping pattern under relay cropping with conservation tillage system

Compared with conventional, BRRIdhan39 with relayed jute gave comparable grain yield while BRRIdhan71 relayed with jute gave highly significant yield compared with conventional. Relayed BRRIdhan71 also gave higher yield than relayed BRRIdhan39 (Fig. 2). In wheat, the conventional system produced comparatively lower grain yield compared with strip and bed planting system(Fig. 3). The gross return and gross margin also were also higher in Jute+BRRIdhan71-strip/bed planting system.

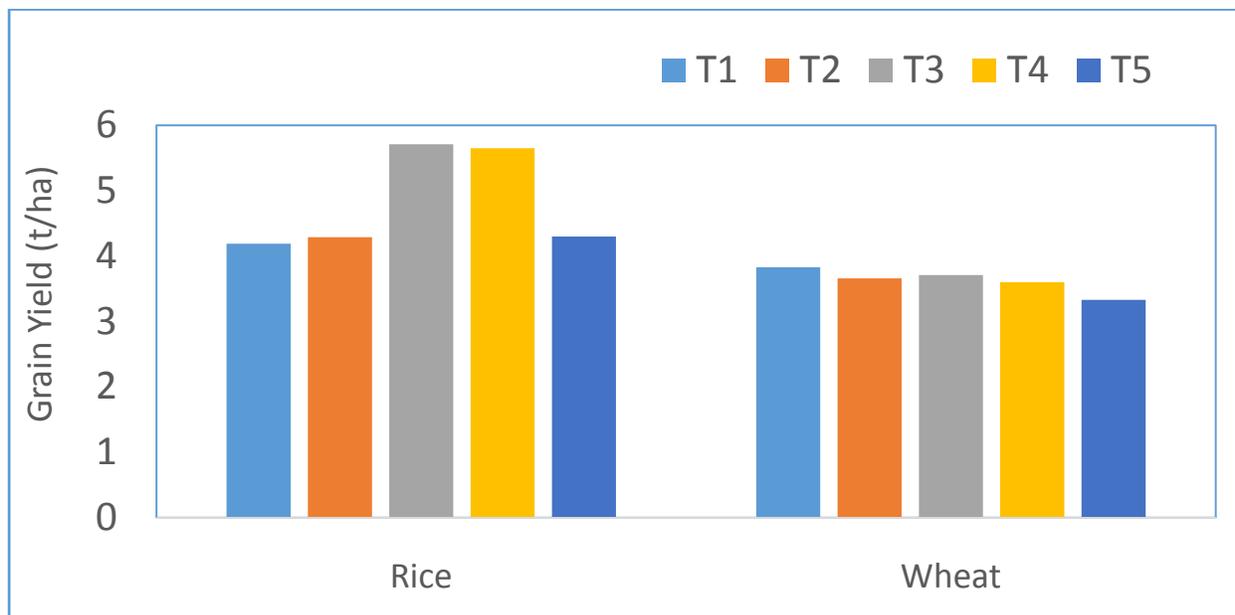


Fig. 2. Yield of rice and wheat under Jute + rice relay-wheat cropping pattern 2017-18

T₁. Jute + relay BRRIdhan39 - strip wheat, T₂. Jute+relay BRRIdhan39-bed planted wheat, T₃. Jute + relay BRRIdhan71 - strip wheat, T₄. Jute+relay BRRIdhan71-bed planted wheat, T₅. Jute-transplanted BRRIdhan39-con. Broadcasted wheat

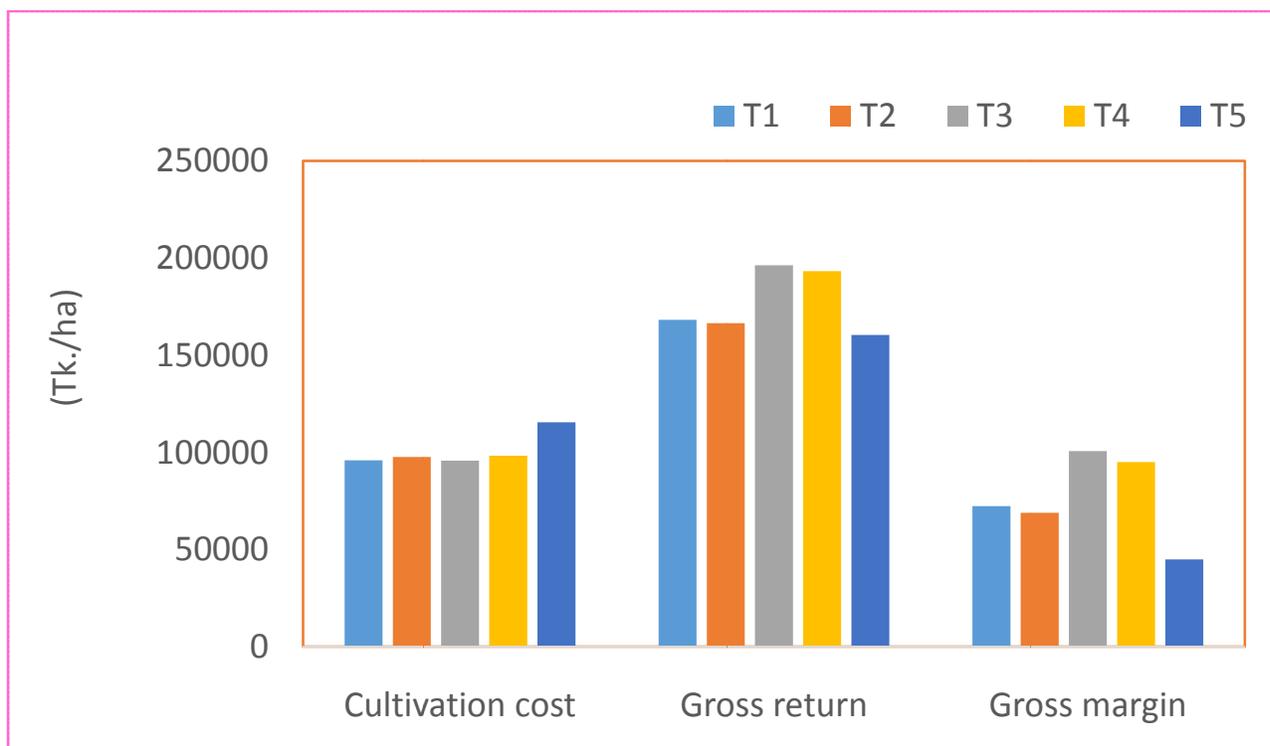


Fig. 3. Economics of rice and wheat under jute+rice relay-wheat cropping pattern 2017-18

T₁. Jute + relay BRRI dhan39 - strip wheat, T₂. Jute+relay BRRI dhan39 - bed planted wheat, T₃. Jute + relay BRRI dhan71- strip wheat, T₄. Jute + relay BRRI dhan71 –bed planted wheat, T₅. Jute - transplanted BRRI dhan39 - con. Broadcasted wheat

11. Research highlight/findings:

- In rice, conventional transplanting of rice and transplanting of rice by rice transplanter gave similar yield under rice-wheat-mungbean cropping system. In wheat, however, yields under PB and ST appeared to be more than CT while in mungbean, the yields of all the treatments were found similar. Due to lower cultivation cost, the ST/PB gave higher profit margin (around 18%) compared to CT although the system productivity more or less found similar among the treatments.
- The bulk density, soil organic matter content, N and P was not influenced but slightly K content was increased due to 100% crop residue incorporation of all the crops in the system.
- Although the conventional transplanting of rice produced higher rice yield compared with dry seeded strip/bed planted rice, the yields of succeeding maize were found higher in strip and bed planting methods. Thus the higher (16-18) profit margin was achieved in ST/PB under rice-maize-mungbean cropping system due to lower cultivation cost with similar system productivity.

- In dry seeded rice-wheat-mungbean cropping systems, the rice equivalent yield was found higher in conventional tillage but the gross margin was remained higher in strip tillage and bed planting system under due to lower cultivation cost.
- Jute + relay BRRI dhan39 -bed/strip planted wheat system gave similar yield with higher gross margin compared with farmers practice while jute + relay BRRI dhan71-bed/strip wheat gave higher yield and higher profit margin compared with jute + relay BRRI dhan39 and also farmer's practice.

B. Implementation Position

1. Procurement:

Description of equipment and capital items	PP Target		Achievement		Remarks		
	Physical	Fin (Tk)	Physical	Fin (Tk)			
	Item	No.		Item	No.		
(a) Office equipment	Notebook	01	115000.00	Notebook	01	114500.00	100% achievement
	Printer	01		Printer	01		
	Scanner	01		Scanner	01		
	Camera	01		Camera	01		
(a) Office equipment	Secretariat table	01	40000.00	Secretariat table	01	37900.00	100% achievement
	File Cabinet.	01		File Cabinet.	01		
(a) Office equipment	Chair	02	20000.00	Chair	02	21000.00	100% achievement
(b) Lab &field equipment	Power tiller	01	335000.00	Power tiller	01	335000.00	100% achievement
	Bed planter	02		Bed planter	02		
	Power tiller operated seeder	01		Power tiller operated seeder	01		
(b) Lab &field equipment	Bicycle	01	20000.00	Bicycle	01	21000.00	100% achievement
(c) Other capital items	-		-	-		-	

2. Establishment/renovation facilities: Not applicable

3. Training/study tour/ seminar/workshop/conference organized:

Description	Number of participant			Duration (Days/weeks/ months)	Remarks
	Male	Female	Total		
(a) Training	55	35	90	1 day	Two numbers
(b) Workshop	17	57	74	1 day	One

Two short training course for farmers using farmer field site as a learning platform was arranged to gear up farmers' knowledge where director research was presented as chief guest.

A final review followed by workshop was held at BIRRI, Gazipur on 27 September 2018 where project director of NATP phase II was presented as chief guest and director PIU, BARC, NATP-2 presented as special guest. The scientists from BARC and BIRRI were also attended the workshop.

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	256,237.00	250,057.00	250,057.00	0	100%	
B. Field research/lab expenses and supplies	765,000.00	719,253.00	719,253.00	0	100%	
C. Operating expenses	305,000.00	293,832.00	293,832.00	0	100%	
D. Vehicle hire and fuel, oil & maintenance	215,000.00	186,964.00	186,964.00	0	100%	
E. Training/workshop/seminar etc.	185,000.00	177,005.00	177,005.00	0	100%	
F. Publications and printing	95,000.00	40,012.00	40,012.00	0	100%	
G. Miscellaneous	100,000.00	86,094.00	85,394.00	-700.00	100%	
H. Capital expenses	530,000.00	530,000.00	529,300.00	+700.00	100%	

D. Achievement of Sub-project by objectives:

Specific objectives of the sub-project	Major technical activities performed in respect of the set objectives	Output(i.e. product obtained, visible, measurable)	Outcome(short term effect of the research)
To assess the extent of benefits of sustainable conservation farming with respect to different cropping systems. To increase productivity and profitability of the and to increase soil health	Conducted on-station trial in Aman rice, wheat and mungbean under rice-wheat-mungbaen systems	Around Tk. 20000/ha was saved using rice transplanter and bed planter/PTOS in rice, wheat and mungben under the systems. Soil K content slightly increased.	About 18% of the productivity profitability of the farmers increased.
Facilitate adoption of productive and sustainable conservation agriculture (CA) based technologies Facilitate adoption of productive and sustainable conservation agriculture (CA) based technologies and to increase productivity and profitability of the farmers	Conducted on-farm trial Aman rice, wheat, mungbean using CA systems	Around Tk. 10000/ha was saved by using bed planter/PTOS in rice, wheat and mungbean under rice-wheat-mungbean systems.	About 9-10% of the profitability of the farmers increased.
Facilitate adoption of productive and sustainable conservation agriculture (CA) based technologies and to increase productivity and profitability of the farmers	Conducted on-farm trial in Rabi (Maize, wheat) season using CA systems	Around Tk. 20000 to 25000/ha was saved by using rice bed planter/PTOS in rice, maziie and mungbean under rice-wheat-mungbean systems.	About 16-18% of the productivity profitability of the farmers increased.
Facilitate adoption of productive and sustainable conservation agriculture (CA) based technologies and to increase profitability of the farmers and to identify suitable rice variety	Evaluated rice varieties under Jute+ rely rice-wheat cropping pattern and CA systems	Around Tk. 20000 to 25000/ha was saved in adopting relay rice cropping and using bed planter/PTOS in wheat.	The productivity (22%) profitability of the farmers increased.
Facilitate adoption of productive and sustainable conservation agriculture (CA) based technologies and to increase knowledge gap	Provided capacity building through training, field day, workshop, exchange ideas etc.	90 Farmers was trained. Exchange of ideas among 100 researchers and extension workers.	Increase knowledge of stakeholders about CA systems

E. Materials Development/Publication made under the Sub-project:

Publication	Number of publication		Remarks (e.g. paper title, name of journal, conference name, etc.)
	Under preparation	Completed and published	
leaflet	01		
Journal publication	01		
Information development		04	Annual report of BRRRI 2017-18
Other publications, if any	-	--	-

F. Technology/Knowledge generation/Policy Support (as applied):

- i. Generation of technology (Commodity & Non-commodity)
Transplanting of rice by rice transplanter followed by direct seeding of wheat and mungbean through strip tillage or bed planting system could be potential technology for the north-west region
- ii. Generation of new knowledge that help in developing more technology in future
Jute+ relay BRRRI dhan71 followed by direct seeding of wheat and mungbean through strip tillage or bed planting system may be an option for conservation agriculture
- iii. Technology transferred that help increased agricultural productivity and farmers' income by
Dry seeding of rice followed by maize and mungbean through strip tillage/bed planting system increase the profitability of farmers by 18%.
- iv. Policy support
Not applicable

G. Information regarding Desk and Field Monitoring

- i) Desk Monitoring [description & output of consultation meeting, monitoring workshops/seminars etc.)
Attended several meetings and workshops where reports were presented on the project activities. Some of the experts suggested that this type of work on conservation agriculture have been done in some extent in the past. New interventions especially use of rice transplanter in CA systems and inclusion of Jute + relay rice-strip/bed planted wheat system

were somewhat new ideas under this project and could be rewarding in the future if found socioeconomically acceptable.

ii) Field Monitoring (time & No. of visit, Team visit and output)

Director (Administration) Dr. Md. Ansar Ali and Director (Research) Dr. Tamallata Aditya of BIRRI visited project activities once. PIU-BARC-NATP-2 field monitoring team also visited the project activities. They were very much enthusiastic regarding the project activities and advised for rapid dissemination of some of the activities.

I. Lesson Learned/Challenges

- Uniform seed dropping through bed planter or PTOS are to be resolved
- Poor establishment of direct seeded rice and high early seedling mortality and therefore require gap filling
- High weed infestation is also a major bottleneck of direct seeded rice, it was resolved using combination of pre and post emergence herbicide.
- Suitable cultivars are still needed for dry seeded rice
- Seeding of wheat through PTOS/bed planter was done before one week compared with conventional broadcasting resulting in higher wheat yield.

J. Challenges

- Reducing knowledge gap of farmers, extension workers are crucial for rapid adoption of CA systems
- Mind set of farmers, extension workers and even scientists is another important issue for adoption CA systems

Signature of the Principal Investigator
Date
Seal

Counter signature of the Head of the
organization/authorized representative
Date
Seal