

Project ID 490

Competitive Research Grant

Sub-Project Completion Report

on

Crop Productivity Enhancement through Agronomic Practices in Sylhet Region

Project Duration

July 2017 to September 2018

Director General's Office
Bangladesh Agricultural Research Institute
Joydebpur, Gazipur-1701



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



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Citation

Crop Productivity Enhancement through Agronomic Practices in Sylhet Region
Project Implementation Unit
National Agricultural Technology Program-Phase II Project (NATP-2)
Bangladesh Agricultural Research Council (BARC)
New Airport Road, Farmgate, Dhaka – 1215
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Acronyms

AEZ	: Agro-Ecological Zone
IPNS	: Integrated Plant Nutrition System
OFRD	: On-Farm Research Division
FSRD	: Farming System Research and Development
MLT	: Multi-Location Testing
DAE	: Department of Agriculture Extension
FYM	: Farm Yard Manure
CP	: Cropping Pattern

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Executive Summary

The average cropping intensity in Sylhet region is low (167%) compared to the national average (190%). The most dominant cropping pattern in the medium highland soils of Sylhet region under AEZ 20 is Fallow-T. aus-T. aman rice. Survey results showed that a vast area of about 2,28,980 ha remains fallow after harvest of T. Aman rice in Rabi season because, soil moisture goes down quickly after harvest of T. aman rice due to lack of irrigation facilities. Cultivation of different rabi crops after harvest of T. aman rice could be possible through agronomic interventions. Screening and selection of crops/varieties against limited water availability, introduction of short duration HYVs, timely planting of short duration T. aman rice, relay cropping, utilization of residual soil moisture after harvest of T. aman rice are some of the options for growing rabi crops in Sylhet region. Application of appropriate crop, soil and water management technologies would be very useful and effective to grow rabi crops in Sylhet under water shortage condition. Replacement of local varieties with HYVs and adoption of proper agronomic management practices could help to increase crop production and yield. There is an ample scope to increase crop production during rabi season both horizontally and vertically in Sylhet region. The FSRD and MLT sites of Sylhet, Sunamganj, Moulvibazar and Habiganj were selected for the study. A quick and informal base line survey on existing crops, cropping patterns and production technologies was conducted with the help of local DAE personnel and OFRD, Sylhet. Appropriate and more efficient cropping systems with inclusion of rabi crops after harvesting T. aman rice to ensure higher productivity of wheat, mustard, pulses and vegetables for sustainable crop production and increase crop intensification and diversification in Sylhet region of Bangladesh. An Inception workshop was organized at OFRD, Sylhet on 4 November, 2017 to discuss the research program. Participants from, DAE, SRDI, BADC and all the scientists and Scientific Assistants of OFRD, Sylhet were present in the Inception workshop. A total of five experiments were conducted to fulfill the objectives. After harvest of T. aman rice, Wheat, Maize, Mustard, Lentil, Grasspea and Chickpea were sown in the farmers' field during last week of November to 1st week of December, 2017. But mustard and pulses in some locations were damaged due to heavy shower (150-180 mm rainfall) in December. Wheat, Lentil, Mustard and Maize were grown successfully in Sylhet, Moulvibazar, Habiganj and Sunamganj under residual soil moisture. Maize was grown successfully as relay crop in T. aman rice. Liming has significant effect on the yield of wheat varieties. Improved cropping patterns (1) Wheat-T. aus-T. aman (2) Mustard-T. aus-T. aman and (3) Wheat-Mungbean-T. aman gave higher yield and return over existing cropping pattern, fallow-T. aus-T. aman. Field days on Mustard, Wheat and Maize was organized at Moulvibazar and Sylhet.

CRG Sub-Project Completion Report (PCR)

A. Sub-project Description

1. **Title of the CRG sub-project:** Crop Productivity Enhancement through Agronomic Practices in Sylhet Region
2. **Implementing organization:** Bangladesh Agricultural Research Institute
3. **Name and full address with phone, cell and E-mail of PI/Co-PI (s):**

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4. **Sub-project budget (Tk):**
 - 4.1 Total: 2000000.00
 - 4.2 Revised (if any):
5. **Duration of the sub-project:**
 - 5.1 Start date (based on LoA signed): 20 July 2017
 - 5.2 End date: 30 September 2018

6. Justification of undertaking the sub-project:

The average cropping intensity in Sylhet region is low (167%) compared to the national average (190%). A survey conducted by DAE showed nearly 1.64 lakh hectares of land in Sylhet division remains fallow during winter (rabi season). Sylhet is one of the special AEZs of Bangladesh due to its soil characters including acidity. Soil pH of the regions ranges from 4.5 to 6.5. Soil organic matter is usually low, status of nitrogen and phosphorus are very low. The most dominant cropping pattern in the medium highland soils of Sylhet region under AEZ 20 is Fallow-T. aus-T. aman rice. Survey showed that a vast area about 2,28,980 ha remains fallow after harvest T. Aman rice in Rabi season because, soil moisture goes down quickly after harvest of T. aman rice and due to lack of irrigation facilities. However, some farmers grow wheat, potato, mustard, chickpea, lentil, kheshari and different vegetables during winter. But the area and production as well as yield are very low.

Cultivation of different rabi crops after harvest of T. aman rice could be possible through agronomic interventions. Screening and selection of crops/varieties against limited water condition, introduction of short duration HYVs, timely planting of short duration T. aman rice, relay cropping, utilization of residual soil moisture after harvest of T. aman rice are some of the options for growing rabi crops in Sylhet region. Application of appropriate crop, soil

and water management technologies would be very useful and effective to grow rabi crops in Sylhet under water limited condition. Replacement of local varieties with HYVs and adoption of proper agronomic management practices could help to increase crop production and yield. There is an ample scope to increase crop production during rabi season both horizontally and vertically in Sylhet region. BARI has already released some varieties of wheat, mustard, pulses and other crops that could be grown under water stress condition. Different management practices in crop, soil and water have also developed by BARI for growing crops under stress environment. Rainfall prevails here from late October to early November usually in every year that offers the opportunity for the production of short duration crop by utilizing the residual moisture. In this context, appropriate and more efficient cropping system which may ensure proper utilization of resources towards increased production per unit area and time on a sustainable basis. Henceforth, the project was undertaken to inclusion of rabi crops after harvesting T.aman rice to ensure higher productivity of wheat, mustard, pulses and vegetables for sustainable crop production and increase crop intensification and diversification in Sylhet region.

7. Sub-project goal: Increase crop production to ensure food and nutritional security, poverty reduction and livelihood improvement of the small and marginal farmers.

8. Sub-project objective (s):

- (i) To increase cropping intensity and crop productivity through introduction of new crops and varieties in Sylhet region under limited water condition.
- (ii) To increase individual crop yield and system productivity through agronomic approaches.
- (iii) To facilitate adoption of appropriate technology in the project area for increasing crop production.

9. Implementing location (s):

Sylhet, Sunamganj, Moulvibazar and Habiganj

10. Methodology in brief

Site selection: The following upazillas were selected under four districts of Sylhet division.

District	Upazilla
Sylhet	Guainghat, Jalalpur
Sunamganj	Dherai
Moulvibazar	Komolganj
Habiganj	Madhobpur

Benchmark Survey

A quick and informal base line survey on existing crops, cropping patterns and production technologies was conducted with the help of local DAE personnels and OFRD, Sylhet. The average cropping intensity in Sylhet region is low (167%) compared to the national average (190%). The most dominant cropping pattern in the medium highland soils of Sylhet region under AEZ 20 is Fallow-T. aus-T. aman rice. Survey showed that a vast area about 2,28,980 ha remains fallow after harvest T. Aman rice in Rabi season because, soil moisture goes down quickly after harvest of T. aman rice and due to lack of irrigation facilities. Farmers usually grow T. aus and T. aman rice.

Inception Workshop

An Inception workshop was organized at OFRD, Sylhet on 4 November, 2017 to discuss the research program. Participants from, DAE, SRDI, BADC and all the scientists and Scientific Assistants of OFRD, Sylhet were present there. Detailed work plan and research activities were discussed elaborately.



Inception Workshop at OFRD, BARI, Sylhet

Field Experimentation

- Five experiments were conducted at Farmers' fields of different MLT and FSRD sites in Sylhet, Sunamganj, Moulvibazar and Habiganj.
- Wheat, Maize, Mustard, Lentil, Grasspea and Chickpea were sown in the farmers' field during last week of November to 1st week of December, 2017.
- But mustard and pulses in some locations were damaged due to heavy shower in December.



Performance of Maize at Farmers Field in Sylhet



Performance of Mustard and Wheat at Farmers Field in Sylhet



Performance of Pulses at Farmers Field in Sylhet



Performance of T.aman rice in Sylhet

11. Results and discussion:

Experiment-1. Performance of pulses and oil seed crops grown under residual soil moisture

Crop: Mustard

The experiment was conducted at farmers' field of Sylhet, Moulvibazar and Sunamganj during 2017-18 to evaluate the performance of short duration mustard varieties grown under residual soil moisture. Six farmers at each location were selected for the trial. Each farmer has 15 decimal lands for the trial. Mustard variety BARI Sarisha-14, BARI Sarisha-15 and Tori-7 were tested. Seeds were sown on 30 October to 5 November, 2017. The crop was fertilized with recommended doses of fertilizers (FRG, 2012) and different intercultural operations were done as and when required. Mustard was harvested in 23-31 January, 2018. Effect of variety on the yield of mustard was noticed at all the locations. Higher seed yield of mustard was found in BARI Sarisha-15 followed by BARI Sarisha-14 and. The lowest yield was found in Tori-7. On an average, about 50% higher yield was obtained in BARI Sarisha 14 and BARI Sarisha 15 over Tori-7 (Table 1).

Table 1. Performance of Mustard varieties grown under residual soil moisture at different locations during 2017-18

Variety	Seed yield of Mustard at different locations (kg/ha)				Field duration (days)
	Sylhet	Moulvibazar	Habiganj	Average	
Tori- 7	700	750	740	730	73
BARI Sarisha-14	1080	1120	1100	1100	78
BARI Sarisha-15	1100	1150	1130	1127	82
Lsd (0.05)	145.5	155.6	153.2	-	-
CV(%)	15.5	14.7	14.2	-	-

Crop: Lentil

The experiment was conducted at farmers' field of Sylhet, Habiganj and Sunamganj during 2017-18 to evaluate the performance of lentil varieties grown under residual soil moisture. Six farmers at each location were selected for the trial. Each farmer has 15 decimal lands for the trial. Lentil variety BARI Moshur-6, BARI Moshur-7 and BARI Moshur-8 were tested. Seeds were sown on 28 October to 4 November, 2017. The crop was fertilized with recommended doses of fertilizers (FRG, 2012) and different intercultural operations were done as and when required. Lentil varieties were harvested in 10-12 March, 2018. Effect of variety on the yield of lentil was noticed at all the locations. Higher seed yield of lentil was found in BARI Moshur-8 followed by BARI Moshur-7. The lowest yield was found in

BARI Moshur-6 but at par to BARI Moshur-7. On an average, about 18% and 12% higher yield was obtained in BARI Moshur-8 over BARI Moshur-7, respectively (Table 2).

Table 2. Performance of Lentil varieties grown under residual soil moisture at different locations during 2017-18

Variety	Seed yield of Mustard at different locations (kg/ha)				Field duration (days)
	Sylhet	Habiganj	Sunamganj	Average	
BARI Moshur-6	680	700	720	700	112
BARI Moshur-7	720	750	760	743	115
BARI Moshur-8	800	850	825	825	110
LSD (0.05)	0.95	0.98	0.92	-	-
CV(%)	14.5	13.7	13.9	-	-

Farmers' Reaction:

Farmers showed their interest to grow BARI Sarisha-14, BARI Sarisha-15, BARI Moshur-7 and BARI Moshur-8 in future.

Experiment-2. Performance of maize varieties grown under residual soil moisture

The experiment was conducted at farmers' field of Sylhet, Moulvibazar and Sunamganj during 2017-18 to evaluate the performance of maize varieties grown under residual soil moisture. Six farmers at each location were selected for the trial. Each farmer has 15 decimal lands for the trial. Maize variety BARI Hybrid Maize-7, BARI Hybrid Maize-9, BARI Hybrid Maize-12 and BARI Hybrid Maize-13 were tested. Seeds were sown on 10-13 November, 2017. The crop was fertilized with recommended doses of fertilizers (FRG, 2012) and different intercultural operations were done as and when required. Maize varieties were harvested in 2nd week of April. Effect of variety on the yield of lentil was noticed at all the locations. Higher seed yield of maize was found in BARI Hybrid Maize-9 followed by BARI Hybrid Maize-7 at Sylhet but significantly higher grain yield was recorded from BARI Hybrid Maize-9 at Moulvibazar and Sunamganj. BARI Hybrid Maize-12 and BARI Hybrid Maize-13 gave lower yield. On an average, about 17% higher yield was obtained in BARI Hybrid Maize-9 over BARI Hybrid Maize-12 and BARI Hybrid Maize-13 (Table 3).

Table 3. Performance of Maize varieties grown under residual soil moisture at different locations during 2017-18

Variety	Grain yield of Maize at different locations (t/ha)			
	Sylhet	Moulvibazar	Sunamganj	Average
BARI Hybrid Maize- 7	7.50	7.40	7.00	7.30
BARI Hybrid Maize- 9	7.65	8.10	7.85	7.87
BARI Hybrid Maize- 12	6.70	6.90	6.60	6.73
BARI Hybrid Maize- 13	6.55	7.10	6.65	6.76
LSD (0.05)	0.55	0.58	0.52	-
CV(%)	14.2	13.8	14.5	-

Farmers' Reaction:

Maize is a new crop to the farmers. They showed their interest to grow BARI Hybrid Maize- 9 in future.

Experiment-3. Performance of Wheat varieties grown under residual soil moisture.

The experiment was conducted at farmers' field of Sylhet, Moulvibazar, Habiganj and Sunamganj during 2017-18 to evaluate the performance of wheat varieties grown under residual soil moisture. Six farmers at each location were selected for the trial. Each farmer has 15 decimal lands for the trial. BARI Gom-25, BARI Gom-26, BARI Gom-28 and BARI Gom-30 were tested. Seeds were sown on 10-12 November, 2017. The crop was fertilized with recommended doses of fertilizers (FRG, 2012) and different intercultural operations were done as and when required. Wheat varieties were harvested in 12-15 March, 2018. Grain yield of wheat did not differ significantly (Table 4). Similar trend was found in all the four locations. On an average grain yield of wheat varieties were varied from 3.45 t/ha (BARI Gom-25) to 3.85 t/ha (BARI Gom-28). Though grain yield did not differ but BARI Gom-28 is found slightly higher yielder.

Table 4. Performance of Wheat varieties grown under residual soil moisture at different locations during 2017-18

Variety	Grain yield of Wheat at different locations (kg/ha)				
	Sylhet	Moulvibazar	Habiganj	Sunamganj	Average
BARI Gom-25	3.60	3.50	3.70	3.00	3.45
BARI Gom-26	3.70	3.75	3.85	3.50	3.70
BARI Gom-28	3.90	3.80	4.00	3.70	3.85
BARI Gom-30	3.75	3.60	3.70	3.25	3.57
LSD (0.05)	NS	NS	NS	NS	-
CV(%)	14.5	13.7	12.2	13.7	-

Experiment-4. Performance of maize varieties in relay cropping with T.aman rice

The experiment was conducted at farmers' field of Sylhet, Moulvibazar and Sunamganj during 2017-18 to evaluate the performance of maize varieties in relay cropping with T.aman rice grown under residual soil moisture. Six farmers at each location were selected for the trial. Each farmer has 15 decimal lands for the trial. Maize variety BARI Hybrid Maize-9, BARI Hybrid Maize-12 and BARI Hybrid Maize-13 were tested. Seeds were sown on 10-12 November, 2017. The crop was fertilized with recommended doses of fertilizers (FRG, 2012) and different intercultural operations were done as and when required. Maize varieties were harvested in 8-10 April, 2018. Effect of variety as relay with T.aman rice was noticed at all the locations. Significantly highest grain yield of maize was found in BARI Hybrid Maize-9. On an average, about 25% and 16% higher yield was obtained in BARI Hybrid Maize-9 over BARI Hybrid Maize-12 and BARI Hybrid Maize-13, respectively (Table 5). Maize variety BARI Hybrid Maize-12 and BARI Hybrid Maize-13 failed to show higher yield as compared to BARI Hybrid Maize-9.

Table 5. Performance of Maize varieties in relay cropping with T.aman rice at different locations during 2017-18

Variety	Grain yield of Maize at different locations (t/ha)			
	Sylhet	Moulvibazar	Sunamganj	Average
BARI Hybrid Maize- 9	7.95	8.10	7.85	7.97
BARI Hybrid Maize- 12	6.50	6.05	6.50	6.35
BARI Hybrid Maize- 13	6.92	7.10	6.65	6.89
LSD (0.05)	0.85	0.58	0.52	-
CV(%)	15.2	14.8	13.5	-

Farmers' Reaction:

Maize is a new crop to the farmers. They showed their interest to grow BARI Hybrid Maize- 9 in future.

Experiment-5. Effect of liming on performance of wheat

The experiment was conducted at farmers' field of Sylhet during 2017-18 to evaluate the response of wheat varieties to liming grown under residual soil moisture. Six farmers at each location were selected for the trial. Each farmer has 15 decimal lands for the trial. Wheat variety BARI Gom-25, BARI Gom-26, BARI Gom-28, BARI Gom-29, BARI Gom-30 and BARI Gom-31 were tested. Seeds were sown on 8-10 November, 2017. The crop was fertilized with recommended doses of fertilizers (FRG, 2012) and different intercultural operations were done as and when required. Wheat varieties were harvested in 10-12 March, 2018. Grain yield of wheat varieties differed significantly due to liming. Higher grain yield of wheat was found in BARI Gom-28, followed by BARI Gom-31 and BARI Gom-26. Lower grain yield was recorded from BARI Gom-29 followed by BARI Gom-25 and BARI Gom-30. However, grain yield did not

varied among the wheat varieties in no liming plots. On an average about 20% yield increased due to liming over no liming irrespective of varieties. Highest grain yield increase was noticed in BARI Gom-31(28.1%) followed by BARI Gom-26 (25%) and BARI Gom-30 (23.3%) due to liming (Table-6).

Table 6. Effect of liming on different Wheat varieties grown under residual soil moisture at Sylhet during 2017-18

Variety	Liming	No liming	% Yield increase
BARI Gom-25	3.5	3.0	16.7
BARI Gom-26	4.0	3.2	25.0
BARI Gom-28	4.2	3.5	20.0
BARI Gom-29	3.2	3.0	6.7
BARI Gom-30	3.7	3.0	23.3
BARI Gom-31	4.1	3.2	28.1
LSD (0.05)	0.82	NS	-
CV(%)	14.5	14.0	-

Farmers' Reaction:

Farmers are very much interested to adopt the technology liming. They showed their interest to grow BARI Gom-26, BARI Gom-28 and BARI Gom-30 with liming.

Experiment-6. Enhancement of yield and productivity of major cropping patterns through agronomic approach under drought environment

CP-1: Mustard-T. aus-T. Aman

The experiment was conducted at farmers' field of Sylhet during 2017-18 to evaluate the performance of improved cropping pattern Mustard-T. aus-T. aman with improved management practices over existing cropping pattern T. aus-T. aman with farmers practice. Six farmers were selected for the trial. Improved varieties of crops, nutrient management and production practices were incorporated in the recommended management practice. Farmers management practices (Variety, fertilizer management and tillage practice) were monitored and yield data were collected from about 30 farmers. In mustard, BARI Sarisha-14 was used. BRRI dhan-48 and BRRI dhan-71 was used for T. aus and T. aman rice. Seeds of mustard were sown on 28 October to 5 November, 2017. Seedlings of T. aus rice (BRRI Dhan 48) and T. aman (BRRI Dhan 71) rice were transplanted in 9-12 May and 8-10 August, respectively. The crops were fertilized with recommended doses of fertilizers (FRG, 2012). Crop management and different intercultural operations were done as and when required. Mustard, T. aus and T. aman rice was harvested

in 5-7 January, 28-30 July and 29-31 October. Results of mustard, T. aus and T. aman rice are shown in Table-7. Performance of mustard was found promising with 1250 kg/ha of seed yield was recorded. Similarly, grain yields of T. aus and T. aman rice was 3.52 t/ha and 4.25 t/ha was recorded. On the other hand farmers practice showed that 2.85 and 3.5 t/ha yield in T. aus and T. aman rice, respectively. About 23 and 21% yield increased in T. aus and T. aman rice due to improved management practice over farmers practice.

Total productivity of the cropping pattern was calculated by converting mustard yield to rice equivalent yield. Total productivity of Mustard-T. aus-T. aman rice cropping pattern increased considerably over farmers practice. System productivity increased in improved cropping pattern over existing cropping pattern to about 61% due to inclusion of mustard and adoption of improved production practice. It was found that the highest gross return, gross margin and BCR were found in improved cropping pattern with recommended practice compared to existing cropping pattern with farmers practice.

Table 7. Productivity and profitability of Mustard-T. aus –T. aman cropping pattern at Sylhet during 2017-18

CP	Seed/grain yield (t/ha)			Rice equivalent yield (t/ha)	GR (Tk/ha/year)	GM (Tk/ha/year)	BCR
	Fallow/Mustard	T. aus	T. aman				
ICP	1.25	3.52	4.25	10.27	255800	145500	2.32
ECP	-	2.85	3.50	6.35	150000	65000	1.76

ICP = Improved Cropping pattern, ECP = existing Cropping Pattern, GR = Gross Return, GM = Gross Margin, BCR = Benefit Cost Ratio

Field duration (days)

Crop	Mustard (BARI Sarisha-14)	T. aus (BRRI Dhan-48)	T. aman (BRRI Dhan-71)
Duration (days)	75-80	110-112	115-117

CP-2: Wheat-T. aus-T. Aman

The experiment was conducted at farmers' field of Sylhet during 2017-18 to evaluate the performance of improved cropping pattern Wheat-T. aus-T. aman with improved management practices over existing cropping pattern T. aus-T. aman with farmers practice. Six farmers were selected for the trial. Improved varieties of crops, nutrient management and production practices were incorporated in the recommended management practice. Farmers management practices (Variety, fertilizer management and tillage practice) were monitored and yield data were collected from about 30 farmers. In wheat, BARI Gom-28 was used. BRRI dhan-48 and BRRI dhan-71 was used for T. aus and T. aman rice. Seeds of wheat were

sown on 8-10 November, 2017. Seedlings of T. aus rice and T. aman rice were transplanted in 10-12 May and 8-10 August, respectively. The crops were fertilized with recommended doses of fertilizers (FRG, 2012). Crop management and different intercultural operations were done as and when required. Wheat, T. aus and T. aman rice was harvested in 10-12 March, 30-31 July and 30-31 October. Results of wheat, T. aus and T. aman rice are shown in Table-8. Performance of wheat was found promising with 3 t/ha of grain yield was recorded. Similarly, yields of T. aus and T. aman rice was 3.2 and 4.2 t/ha was recorded. But farmers practice showed that 2.9 and 3.6 t/ha yield was attained in T. aus and T. aman rice, respectively.

Total productivity of the cropping pattern was calculated by converting wheat yield to rice equivalent yield. Total productivity of Wheat-T. aus-T. aman rice cropping pattern increased considerably over farmers practice. System productivity increased in improved cropping pattern over existing cropping pattern to about 60% due to inclusion of wheat and adoption of improved production practice. It was found that the highest gross return, gross margin and BCR were found in improved cropping pattern with recommended practice compared to existing cropping pattern with farmers practice.

Table 8. Productivity and profitability of Wheat-T. aus –T. aman cropping pattern at Sylhet during 2017-18

CP	Grain yield (t/ha)			Rice equivalent yield (t/ha)	GR (Tk/ha/year)	GM (Tk/ha/year)	BCR
	Fallow/Wheat	T. aus	T. aman				
ICP	3.0	3.2	4.2	10.5	258500	148500	2.35
ECP	-	2.9	3.6	6.5	160000	75000	1.84

ICP = Improved Cropping pattern, ECP = existing Cropping Pattern, GR = Gross Return, GM = Gross Margin, BCR = Benefit Cost Ratio

Field duration (days)

Crop	Wheat (BARI Gom-28)	Mungbean (BARI Mung-6)	T. aman (BRRI Dhan-71)
Duration (days)	102-108	62-65	115-117

CP-3: Wheat-Mungbean-T. Aman

The experiment was conducted at farmers' field of Sylhet during 2017-18 to evaluate the performance of improved cropping pattern Wheat-Mungbean-T. aman with improved management practices over existing cropping pattern T. aus-T. aman with farmers practice. Six farmers were selected for the trial. Improved varieties of crops, nutrient management and production practices were incorporated in the recommended management practice. Farmers management practices (Variety, fertilizer management and tillage practice) were monitored and yield data were collected from about 30 farmers. In wheat, BARI Gom-28 was used. BARI Mung-6 and BRRI dhan-71 was used for mungbean and T. aman rice. Seeds of

wheat and mungbean were sown on 8-10 November and 28-30 March. Seedlings of T.aman rice were transplanted in 10-12 August. The crops were fertilized with recommended doses of fertilizers (FRG, 2012). Crop management and different intercultural operations were done as and when required. Wheat, Mungbean and T.aman rice was harvested in 10-12 March, 27-28 May and 29-30 October. Results of wheat, Mungbean and T.aman rice are shown in Table-9. Performance of wheat was found promising with 3.5 t/ha of grain yield was recorded. Similarly, yields of Mungbean and T.aman rice was 1.7 t/ha and 4.2 t/ha was recorded. But data collected from farmers practice showed that 3.1 and 3.6 t/ha yield was attained in T. aus and T. aman rice, respectively.

Total productivity of the cropping pattern was calculated by converting wheat and mungbean yield to rice equivalent yield. Total productivity of Wheat-Mungbean-T.aman rice cropping pattern increased considerably over farmers practice. System productivity increased in improved cropping pattern over existing cropping pattern to about 70% due to inclusion of wheat and mungbean. It was found that the highest gross return, gross margin and BCR were found in improved cropping pattern with recommended practice compared to existing cropping pattern with farmers practice.

Table 9. Productivity and profitability of Wheat-Mungbean –T. aman cropping pattern at Sylhet during 2017-18

CP	Seed/grain yield (t/ha)			Rice equivalent yield (t/ha)	GR (Tk/ha/year)	GM (Tk/ha/year)	BCR
	Fallow/Wheat	Mungbean/T. aus	T. aman				
ICP	3.5	1.7	4.5	11.4	280500	170300	2.55
ECP	-	3.1	3.6	6.7	165000	85000	1.89

ICP = Improved Cropping pattern, ECP = existing Cropping Pattern, GR = Gross Return, GM = Gross Margin, BCR = Benefit Cost Ratio

Field duration (days)

Crop	Mungbean (BARI Mung-6)	T. aus (BRRI Dhan-48)	T. aman (BRRI Dhan-71)
Duration (days)	62-65	110-112	115-117

Farmers' Reaction:

Adoption of modern technologies by the farmers will increase yield and total production of mustard, maize, wheat, and T. aman rice in the project area. Therefore, Farmers showed their keen interest to adopt new technologies if the seeds of new varieties are available.

Field day

Field days on Mustard, Wheat and Maize were organized at Moulvibazar and Sylhet. A bout 50 participants including farmers and representatives from DAE, SRDI, BADC, NGOs took part in each field day. Scientists from OFRD, Sylhet and RARS, Akbarpur also participated. Farmers were happy to see the performance of BARI developed mustard, wheat and maize varieties and showed their keen interest to grow in future if seed is available.



A Field day on Mustard at Moulvibazar

12. Research highlight/findings:

- Mustard variety BARI Sarisha 14 gave higher yield under limited water resources. About 50% higher yield was obtained in BARI Sarisha 14 and BARI Sarisha 15 over Tori-7.
- Lentil variety BARI Mashur-8 performed better in relay cropping with T.aman rice under residual soil moisture. On an average, about 18 and 12% higher seed yield was obtained in BARI Moshur-8 over BARI Moshur-6 and BARI Moshur-7, respectively.
- Significantly higher grain yield of maize was found in BARI Hybrid Maize-9. On an average, about 17% higher grain yield was obtained in BARI Hybrid Maize-9 over BARI Hybrid Maize-12 and BARI Hybrid Maize-13
- Grain yield of wheat varieties increased significantly due to liming@1.5 t/ha. About 20% grain yield increased due to liming over no liming irrespective of varieties.
- Wheat variety BARI Gom 28, BARI Gom 31 and maize variety BAR Hybrid Maize 12 and BAR Hybrid Maize 13 gave higher yield under residual soil moisture
- Mustard, Mungbean and Wheat can be grown successfully in T. aus-T. aman cropping pattern in Sylhet region.
- Total productivity of Improved Cropping Patterns increased 60-70% due to inclusion of mustard, wheat and mungbean in the existing cropping system and adoption of improved production practices.

B. Implementation Position

1. Procurement:

Description of equipment and capital items	PP Target		Achievement		Remarks
	Phy (#)	Fin (Tk)	Phy (#)	Fin (Tk)	
(a) Office equipment	Laptop (#1) Digital Camera (#1)	85000	Laptop (#1) Digital Camera (#1)	81469	

2. Establishment/renovation facilities:N/A

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

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

Description	Number of participant			Duration (Days)	Remarks
	Male	Female	Total		
(a) Field days	145	55	200	1 day	Four field days were organized. Fifty participants for each field day
(b) Workshop	17	3	20	1 day	An Inception Workshop was organized for one day.

C. Financial and physical progress

Items of expenditure	Total approved budget	Fund received	Actual expenditure	Balance/ unspent	Physical progress (%)	Fig in Tk
						Reasons for deviation
A. Contractual staff salary	374490	335000	332215	2785	88.71	
B. Field research/lab expenses and supplies	900000	833284	831760	1524	92.42	
C. Operating expenses	250000	249030	256114	-7084	102.4	
D. Vehicle hire and fuel, oil & maintenance	120000	97315	95000	2315	79.17	
E. Training/workshop/seminar etc.	100510	99235	99235	1275	98.73	
F. Publications and printing	100000	83000	0	83000	0	
G. Miscellaneous	70000	68491	52181	17819	74.54	
H. Capital expenses	85000	85000	81469	3530	95.84	

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

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)
1. To increase cropping intensity and crop productivity through introduction of new crops and varieties in Sylhet region under limited water condition.	➤ Site selection, benchmark survey, field experimentation	<ul style="list-style-type: none"> • An informal Bench mark survey was completed and existing crops and cropping pattern and farmers' practice was identified. • Wheat, Lentil, Mustard and Maize grown successfully in Sylhet, Moulvibazar, Habiganj and Sunamganj under residual soil moisture. 	About 20-30% higher seed yield of mustard, maize wheat and lentil was obtained in HYVs over existing farmers variety.
2. To increase individual crop yield and system productivity through agronomic approaches.	➤ Field experimentation, Data collection and recording, Data analysis	<ul style="list-style-type: none"> • Liming has significant effect on the yield of wheat varieties. • Improved cropping patterns (1) Wheat-T.aus-T.aman (2) Mustard-T.aus-T.aman and (3) Wheat-Mingbean-T.aman gave higher yield and return over existing cropping pattern, fallow-T.aus-T.aman. 	<ul style="list-style-type: none"> • Crop productivity increased considerably due to application of improved management practices e.g. use of HYVs of crops, IPNS basis nutrient management. • Farmers' income also increased due to higher yield obtained in improved management practices.
3. To facilitate adoption of appropriate technology in the project area for increasing crop production.	➤ Field day	<ul style="list-style-type: none"> • Farmers were happy to encourage the performance of BARI developed mustard, wheat and maize varieties and showed their interest to grow in future if seed is available. 	Adoption of modern technologies by the farmers will increase yield and total production of mustard, maize, wheat, and T.aman rice in the project area.

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	
Technology booklet	-	-	
Journal publication	-	-	
Information development			
Other publications, if any (News paper)	-	02	Local daily newspapers

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

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

Increase cropping intensity and crop productivity through introduction of new crops and varieties in Sylhet region during fallow period.

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

Knowledge on new crop varieties and improved management practices for growing crops under limited water resources at greater Sylhe region.

iii. Technology transferred that help increased agricultural productivity and farmers' income

Adoption of modern technologies by the farmers could increase yield and total productivity of mustard, maize, wheat, and T.aman rice in the project area.

iv. Policy Support

Encourage Farmers (technological support, training support, provision of subsidy, soft loans, etc.) to adopt the new variety of crops and technology.

G. Information regarding Desk and Field Monitoring

i) Desk Monitoring [description & output of consultation meeting, monitoring workshops/seminars etc.):

Description	Output
Program Planning Workshop	Detailed research program was discussed with DAE, BADC, SRDI and OFRD, BARI
Consultation meeting with scientists and Field staff	Some locations, crops and varieties were changed as per suggestions

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

Time	No. of visit	Team visit	Output
January 2018	3	DAE, BADC, NGOs	• Under graduate students and professor of SAU observed the machine. They were very happy to see the operation of the machine
April, 2018	1	Director (Research) with associates	• Monitoring team made by Director research satisfied the research progress

H. Lesson Learned/Challenges (if any)

- i) For successful and timely completion of any sub-project, allocation of fund/resources needs to be ensured
- ii) To achieve any successes/visible output in any agricultural sub-project, minimum time duration of the project should be 3 years

I. Challenges (if any)

- Excessive rainfall just after sowing of Rabi crops (December, 2017)
- Absentee farmers

Signature of the Principal Investigator
Date

Seal

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

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