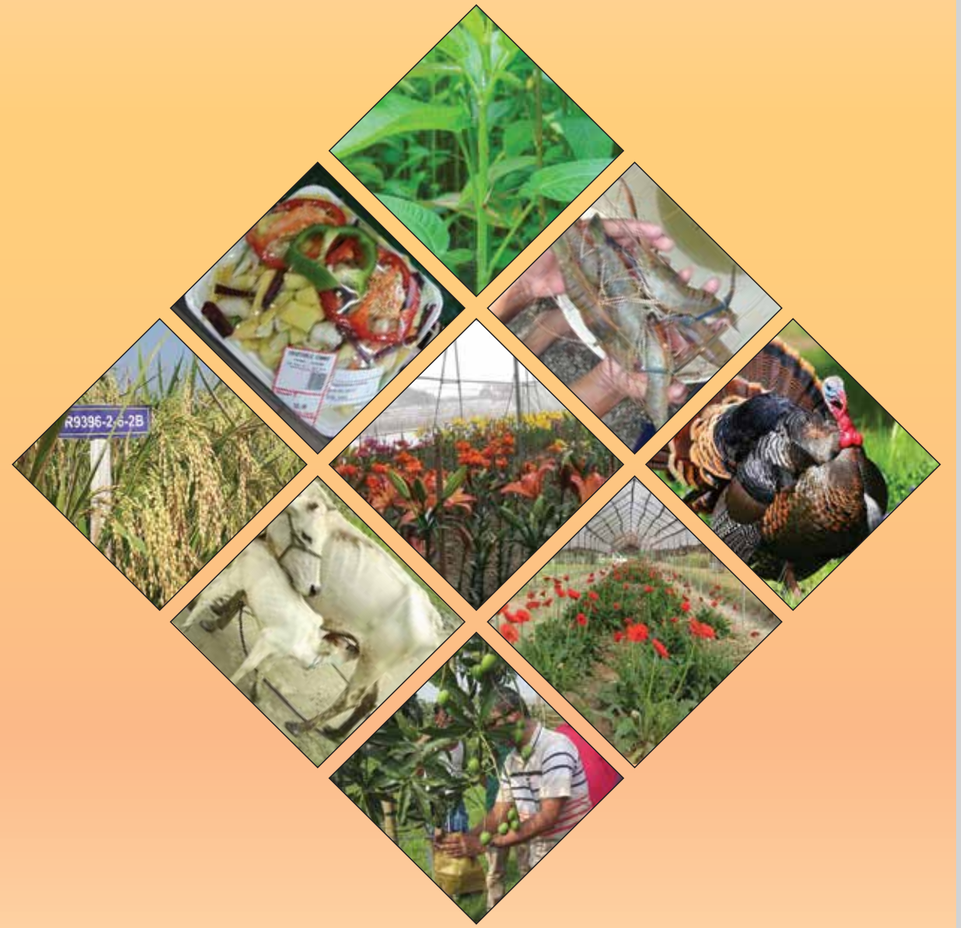
Annual Report
(2017-18)



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

December 2018

NATP-2
BARC Component
Enhancing Agricultural Technology Generation

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Annual Report

(July 2017- June 2018)

BARC Component:
Enhancing Agricultural Technology Generation

Project Implementation Unit-BARC
National Agricultural Technology Program-Phase 11 Project (NATP-2)
Administrative Building (2nd Floor)
Bangladesh Agricultural Research Council
Farmgate, Dhaka-1215

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Preface

Bangladesh is predominantly an agricultural country and it plays a pivotal role in national GDP, food security, poverty reduction and employment generation. Bangladesh has achieved self-sufficiency in food grain production through developing new agricultural technologies by the National Agricultural Research Systems (NARS) and disseminating those to the farmers by the extension agencies. However, continuous supports are needed to grow adequate, safe and nutritious food for the growing populations in the interface of consistent cultivable land shrinkage and climate change vulnerability. Hence, agricultural research needs to be strengthened to cope up with the upcoming situation to generate demand-driven technologies for enhancing agricultural productivity.

The agriculture of Bangladesh is now transforming from 13w input subsistence to a commercial one with higher level input use and production of high-value agricultural commodities. Supports are needed for transforming agriculture towards commercial one. The National Agricultural Technology Program-Phase II (NATP-2) project has been supporting technically and financially to activities aimed at boosting agricultural production through productivity enhancement, and increasing income of small holders.

The Project Implementation Unit (PIU) of Bangladesh Agricultural Research Council (BARC) has been implementing the Component-i which is related to enhancing agricultural technology generation out of five interrelated components. The research component has been supporting the generation and development of technologies on crops, fisheries and livestock granting subprojects of Competitive Research Grant (CRG) and Program based Research Grant (PBRG). The component is also assisting institutional capacity building of the NARS through human resource development and strengthening the research and training facilities of NARS, particularly in outreach stations.

The Annual Report for the year 2017-18 consists of implementation progress ol CRGs and PBRGs, monitoring and evaluation, environmental and social safeguard management, human resource development, procurement and financial management. Different chapters of this report describe the progress of technology generation, development and validation and related issues. This piece of the report would be useful for all the stakeholders and others.

I appreciate the contribution and sincere efforts of all the researchers of NARS, universities. I acknowledge the hard work of the PIU-BARC personnel and the technical divisions of BARC to visualize the hard work through this report.

Dr. Md. Kabir Ikramul Haque
Executive Chairman
BARC

Foreword

Bangladesh is a resource-poor country and its economy, food security, poverty reduction and employment generation mainly depends on agriculture. Increasing productivity in a sustainable manner under all sub-sectors of agriculture is the need of the day to provide the growing demand of the ever increasing population. Although, agricultural technology system in Bangladesh has made significant contribution in increasing yields of different crops and elevating total agricultural productivity over the last few decades, yet there is a growing concern about how to meet the diversified food demand for the increasing population with shrinking natural resource base. Development of location specific, low input, eco-friendly demand oriented, climate resilient agricultural and ICT based technologies would obviously contribute for sustainable growth in agriculture.

National Agricultural Technology Program-Phase 11 Project (NATP-2), a national project of the People's Republic of Bangladesh jointly funded by GoB/IDA/IFAD/USAID has been started its interventions through the coordinated efforts of Ministry of Agriculture (Lead Ministry) and Ministry of Fisheries and Livestock to improve national agricultural productivity, market linkage and farm income, with a particular focus on small, marginal and female farmers. The agricultural research component -**Enhancing Agricultural Technology Generation** of NATP-2 is being implemented by the Project Implementation Unit (PIU) of BARC since 2016 in order to generate demand-driven technologies on crops, fisheries and livestock through executing basic, strategic, applied and adaptive research including research on cross cutting issues with NARS and non-NARS institutes for increasing the productivity and production of agricultural commodities.

A total number of 190 Competitive Research Grant (CRG) and 26 Program Based Research Grant (PBRG) sub-projects are being implemented by the 27 different NARS and non- NARS institutes. Although, implementation activities of the CRG sub-projects are on-going but till date, some of the project shows encouraging results. It may be expected that with the proper implementation of CRG and PBRG sub-projects, demand-driven agricultural technologies will be generated which will help to achieve the food and nutritional security of Bangladesh.

Human resources are the vital force of national development. Thus agricultural manpower development is essential and more emphasis should be given to the NARS scientists. It is essential to develop scientists in such a way that they can face the future research challenges in all sub-sectors of agriculture. PIU-BARC, NATP-2 has already selected and awarded 120 PhD programs (60 foreign & 60 local) to the scientists of NARS and Ministry of Agriculture against the targeted 140. Out of 20 local PhD programs allocated for DAE, DLS and DoF, 10 PhD programs have already been awarded to the officials of DAE. Selection of candidates for the PhD programs of DLS and DoF are under process. A total of 07 participants participated in foreign short term training on "Financial and Office Management" at Malaysia. So far 800 persons participated in 24 local trainings while 2512 participants attended in 22 events of local seminars/ workshops. Monitoring and Evaluation (M&E) Cells have been established at PIU-BARC, BARC and recipient institute level and they are now functional.

This annual report includes the activities performed by PIU-BARC, NATP-2 during FY 2017-18. I hope this publication will be useful to the scientists, extension workers, teachers, students and other stakeholders.

Last but not least, I gratefully acknowledge the direct and indirect contribution and support of all concerned extended in carrying out the activities of PIU-BARC component successfully during the FY 2017-18 as well as publishing this annual report.

Dr. Mian Sayeed Hassan
Director
PIU-BARC, NATP-2

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Abbreviations and Acronyms

AERS	:	Agricultural Economics and Rural Sociology
AI	:	Artificial Insemination
AIF-1	:	Agricultural Innovation Fund
ARS	:	Agricultural Research Station
BARC	:	Bangladesh Agricultural Research Council
BARD	:	Bangladesh Academy for Rural Development
BARI	:	Bangladesh Agricultural Research Institute
BAU	:	Bangladesh Agricultural University
BFRF	:	Bangladesh Fisheries Research Forum
BFRI	:	Bangladesh Fisheries Research Institute
BFRI	:	Bangladesh Forest Research Institute
BIM	:	Bangladesh Institute of Management
BINA	:	Bangladesh Institute of Nuclear Agriculture
BJRI	:	Bangladesh Jute Research Institute
BLRI	:	Bangladesh Livestock Research Institute
BRRI	:	Bangladesh Rice Research Institute
BSRI	:	Bangladesh Sugar crops Research Institute
BSRTI	:	Bangladesh Sericulture Research and Training Institute
BTRI	:	Bangladesh Tea Research Institute
BSMRAU	:	Bangabandhu Sheikh Mujibur Rahman Agricultural University
CA	:	Conservation Agriculture
CDB	:	Cotton Development Board
CN	:	Concept Note
Co-PI	:	Co-Principal Investigator
CRG	:	Competitive Research Grant
CSO	:	Chief Scientific Officer
CT	:	Conventional Tillage
CU	:	Chittagong University
CVASU	:	Chittagong Veterinary and Animal Science University
DAE	:	Department of Agricultural Extension
DLS	:	Department of Livestock Services
DoF	:	Department of Fisheries
DPP	:	Development Project Proposal
DU	:	Dhaka University
EC	:	Executive Council
EMF	:	Environmental Management Framework
ERD	:	Economic Relation Division
FRP	:	Full Research Proposal
FY	:	Financial Year
GDP	:	Gross Domestic Product
GIF	:	Gender and Inclusion Framework
GoB	:	Government of Bangladesh
GTI	:	Graduate Training Institute
HOPE	:	Head of Procuring Entity
HRC	:	Horticulture Research Centre
HRD	:	Human Resource Development
HSTU	:	Hajee Mohammad Danesh Science and Technology University

IDA	:	International Development Association
IFAD	:	International Fund for Agricultural Development
IPM	:	Integrated Pest Management
KU	:	Khulna University
ISM	:	Implementation Support Mission
LoA	:	Letter of Agreement
M&E	:	Monitoring and Evaluation
MD	:	Member Director
MoA	:	Ministry of Agriculture
NARS	:	National Agricultural Research System
NATP	:	National Agricultural Technology Project
NARI	:	National Agricultural Research Institute
NATA	:	National Agricultural Training Academy
NRM	:	Natural Resource Management
NGO	:	Non-Governmental Organization
NIB	:	National Institute of Bio-technology
NSTU	:	Noakhali Science and Technology University
OFRD	:	On Farm Research Division
P&E	:	Planning and Evaluation
PAD	:	Project Appraisal Document
PBRG	:	Program Based Research Grant
PCR	:	Project Completion Report
PDO	:	Project Development Objective
PhD	:	Doctor of Philosophy
PHTD	:	Post Harvest Technology Division
PI	:	Principal Investigator
PIM	:	Project Implementation Manual
PIU	:	Project Implementation Unit
PMP	:	Project Management Plan
PMU	:	Project Management Unit
PSO	:	Principal Scientific Officer
PSTU	:	Patuakhali Science and Technology University
R & D	:	Research and Development
RADP	:	Revised Annual Development Program
RARS	:	Regional Agricultural Research Station
RPA	:	Reimbursable Project Aid
RU	:	Rajshahi University
SAU (Dhaka)	:	Sher-e-Bangla Agricultural University
SAU (Sylhet.)	:	Sylhet Agricultural University
SDA	:	Sustainable Development Associates
SMF	:	Social Management Framework
SoE	:	Statement of Expenditure
SRDI	:	Soil Resources Development Institute
SUST	:	Shahjalal University of Science and Technology
SSURDA	:	Society for Sustainable Development for Rural Urban Area
USAID	:	United States Agency for International Development
VAT	:	Value Added Tax
WB	:	World Bank

Executive Summary

Among the five inter related components of NATP-2, Component-1 (**Enhancing Agricultural Technology Generation**) is being implemented by PIU,BARC with the National Agricultural Research System (NARS) and non-NARS institutes (Public Universities, NGOs and other Organizations). The research component has been supporting the generation and development of agricultural technologies on crops, fisheries and livestock through implementing Competitive Research Grant (CRG) and Program Based Research Grant (PBRG) sub-projects for increasing the productivity and production of agricultural commodities.

A total of one hundred ninety (190) CRG sub-projects are being implemented by the 27 (Twenty seven) different NARS and non-NARS institutions against the targeted one hundred (100) CRG sub-projects. Executive Council (EC) of BARC has already approved 39 PBRG sub-projects against the targeted 33 PBRG sub-projects. Thirty eight (38) PBRG sub-projects have already been awarded but signing of Letter of Agreement (LoA) of 36 has been completed. A lump-sum amount of fund (BDT 5.50 crore) has been disbursed to the 26 PBRG sub-projects for initiating the sub-project activities. The implementation progress of CRG sub-projects are being regularly monitored through Desk and Field Monitoring. Out of 190 CRG sub-projects, 152 sub-projects have already been monitored by the Monitoring Teams of the Technical Divisions of BARC and PIU-BARC through prescribed format. Monitoring reports of Monitoring Teams indicated that the implementation progress of almost all the CRG sub-projects is satisfactory and some projects shows encouraging findings, although sub-projects are not yet completed.

Out of 140 PhD programs of which 60 local and 60 foreign are already awarded to the NARS Scientists (118) and Officials of Ministry of Agriculture (02). Out of 20 local PhD programs allocated for DAE, DLS and DoF, 10 PhD programs have already awarded to the Officials of DAE. The rest 10 local PhD programs are under process for awarding to the Officials of Department of Livestock Services (DLS) and Department of Fisheries (DoF). Twenty Four (24) skill development local training programs on different areas like Budget and Financial Reporting, Public Procurement Management, Financial Management, Research Methodology, Integrated Pest Management for major Crops etc. have been conducted. A total of 800 participants attended in those events. A 08 days long foreign training program on “Financial and Office Management” has been organized at the institute of International Malaysia Education Center (IMEC), University of Malaysia Sarawak (UNIMAS), Malaysia having 07 participants from BARC (05) and MOA (02). Moreover, 22 local workshops and seminars have been organized. A total of 2512 participants were attended in those events.

Six consultants/specialists and 15 core contractual staff has been procured for smooth running of the project activities. Procurement of the rest consultants/specialists is under process. Three vehicles (Pick-up-01, Microbus-01 and Car-01) were procured. Two packages i.e Laptop and Online UPS were also procured through pooled procurement.

The total expenditure incurred BDT 5067.23 lakh during July 2017 to June 2018 as against the RADP Allocation BDT 5118.00 Lakh for the FY 2017-2018. The financial progress was 99.01%.

Chapter 1

NATP-2 in Brief

1.1: Introduction

Bangladesh is predominantly an agricultural country and agriculture continues to be the driving force of the economy. Agriculture sector comprises crops, livestock, fisheries and forestry. This sector contributes a major share in national GDP 14.22% and employs about 44.00% of the working force in FY 2016-2017. Agriculture plays a dominant role in national economy in terms of sustainable land management, food security, employment, value addition and export earnings. Bangladesh agriculture has made a tremendous progress over the past four decades. Food (Rice, wheat, maize) production has increased significantly from around 15 million tons in 1971 to about 39 million tons in 2016-2017. National GDP growth rate increased to 7.24% in FY 2016-2017 from 7.05% in FY 2015-2016.Within the agriculture sector, most of the sub-sectors performed well during FY2016-17. NARS institutes and extension line agencies played a vital role by developing and disseminating new agricultural technologies to the farmers and development of effective research-extension linkages through the integrated approaches adopted by the Ministry of Agriculture and Ministry of Fisheries and Livestock, Government of Bangladesh.

Bangladesh agriculture is now transforming rapidly from low input subsistence to commercial agriculture with higher levels of input use and different high value agricultural commodities production. Although Bangladesh achieved self- sufficiency in food grain but yet a lot of supports are needed for transforming agriculture towards commercial farming. Moreover, sustainable intensification and diversification of agriculture through technological change requires an efficient and productive national agricultural technology system, comprising agricultural research (Technology development and refinement) and agricultural extension (Technology dissemination and adoption). These needs to be supported by appropriate value addition and market linkages through smallholders' participation in establishing commodity supply chains for higher value agriculture.

While overall poverty has significantly declined over the last two decades, the poverty in rural areas has not declined as fast as in urban areas; the proportion of people living in extreme poverty in rural areas is still higher than in urban areas. Hence, improvement of agriculture and acceleration of its growth is essential for achieving further economically, socially and environmentally sustainable economic growth and poverty reduction.

To achieve these strategic goals, the GoB sought the support of Development Partners (IDA) to provide technical and financial support to activities aimed at boosting agricultural production through productivity enhancement, and increasing smallholders' income. The World Bank, jointly with IFAD and USAID, decided to provide financial support to GoB for the National Agricultural Technology Program- Phase II Project (NATP-2). Thus, National Agricultural Technology Program- Phase II Project (NATP-2), a national project of the People's Republic of Bangladesh funded by GoB/IDA/IFAD/USAID has been started its interventions through the coordinated efforts of Ministry of Agriculture (Lead Ministry) and Ministry of Fisheries and Livestock.

1.2: Objectives

The overall objective of the project is to support the strategy of the Government of Bangladesh (GoB) to improve national agricultural productivity, market linkage and farm income, with a particular focus on small, marginal and female farmers.

The Project Development Objective (PDO) of National Agricultural Technology Program-Phase II Project (NATP-2) is to increase agricultural productivity of smallholder farms and improve smallholder farmers' access to markets in selected districts. The PDO will be achieved through the generation and release of more productive and locally adapted technologies, enhancing availability of quality seeds/breeds/fingerlings/breeding materials at the small farm level and providing relevant production, value addition, food safety and marketing support.

1.3: Components

National Agricultural Technology Program-Phase II Project (NATP-2) is consists of five inter-related components addressing a range of constraints to technology generation, to technology transfer and adoption at farm level, and to farmers' access to markets. The components are:

Component – 1 Enhancing Agricultural Technology Generation is being implemented by the Project Implementation Unit (PIU) of Bangladesh Agricultural Research Council (BARC);

Component – 2 Supporting Crop Development is being implemented by the PIU of Department of Agricultural Extension (DAE);

Component – 3 Supporting Fisheries Development is being implemented by the PIU of Department of Fisheries (DOF);

Component – 4 Supporting Livestock Services is being implemented by the PIU of Department of Livestock Services (DLS) and

Component – 5 Project Management is being implemented by the Project Management Unit (PMU), NATP-2, MoA.

Chapter 2

Component-1 in Brief

2.1: Introduction

Component – 1: Enhancing Agricultural Technology Generation is being implemented by the Project Implementation Unit (PIU) of Bangladesh Agricultural Research Council (BARC). As an apex body, BARC is coordinating the agricultural research with all NARS and non-NARS institutes (Public Universities, NGOs and other organization).The Component has been supporting the need based research and development of crops, fisheries and livestock. The purpose of this component is to generate demand-led agricultural technologies (Improved varieties/breeds/fingerlings and production & post-production management packages, socio-economic, etc) in order to increase productivity and production and also to provide location and problem specific technological solutions to production problems under specific agro-ecological conditions and constrained areas.

It will contribute to achieving the Project Development Objective (PDO) by helping to improve the performance of the National Agricultural Research System (NARS) through supporting the development of agricultural technologies and the strengthening of agricultural research institutions.

The research component has been supporting Competitive Research Grant (CRG) Programs for implementing short to medium term research activities based on farmers' need and with participation of NARS Institutes, Public Universities and private sectors as well as supporting Program Based Research Grant (PBRG) in Public Sector Agricultural Research Institutes for implementing longer duration research initiatives in strategic areas including varietal development, bio-technology and climate vulnerability, etc. The component is also assisting institutional capacity building of the NARS through human resource development as well as strengthening the research and training facilities of NARIs, particularly in outreach stations.

2.2: Specific Objectives

a) One hundred (100) Competitive Research Grant (CRG) proposals will be undertaken;
b) Thirty three (33) Program Based Research Grant (PBRG) proposals will be undertaken;
c) Forty (40) improved technologies will be demonstrated in the farmers' fields of project areas;
d) Targeted HRD Programs (80 local PhDs, 60 foreign PhDs, short-term training, study visit, etc.) will be implemented and
e) Research and training facilities in NARIs, particularly in outreach stations (RARS/ARS) will be improved.

2.3: Activities

a) Awarding 100 (one hundred) CRG sub-projects;
b) Awarding 33 (thirty three) PBRG sub-projects;
c) Arrangement for effective supervision, monitoring and evaluation of the awarded CRG & PBRG sub-project by the respective recipient research organizations and BARC as well as PIU-BARC.
d) Improving research and training facilities in outreach stations (RARS/ARS) of NARIs;
e) Implementing HRD Programs – 80 local PhDs, 60 foreign PhDs, Short-term training, Study visit, etc.;
f) Organizing need based workshop/seminar/consultation meeting, etc.;
g) ICT facilities would be strengthened at the NARS institutes to develop and establish information network connectivity between Head Quarter and Regional Stations of NARIs.

2.4: Administration and Implementation Arrangements

PIU-BARC will be headed by a full-time Director on deputation from BARC. The Director will have full freedom to make decisions related to research component of the project as well as financial management decisions independently for the unit within the financial powers that has been delegated to him/her under the "Delegation of Financial Powers for Development Projects" issued by the GoB, and within the provision of "Project Legal Documents" like PAD and Financing Agreement (FA).The Executive Chairman of BARC as the Head of the Procuring Entity (HOPE) and the Director of PIU-BARC as the authorized person will have authority for all the procurements as per the delegation of financial power for development projects. However, Director of PIU-BARC will be accountable for implementing the procurement. The core contractual staffs and consultants will be recruited through open advertisement.

Research activities will be managed by PIU-BARC through NARIs, public universities and other research providers. PIU-BARC would be responsible for implementation of enhancing agricultural technology generation component (prioritization, review, approval, monitoring and evaluation of research sub-project proposals submitted by NARIs/ public university/private researchers), manage AIF-1 grants, fiduciary requirement (procurement, financial management and audit compliance), capacity building and human resources development in NARS institutes. All the activities will be performed in consistence with GoB and World Bank fiduciary requirements. The Executive Council (EC) of BARC will approve research sub-projects and will oversee the implementation of those research sub-projects.

PIU-BARC is primarily responsible for proper implementation of its activities. Besides, there are different committees to oversee, supervise, coordinate and monitor the progress and steer the overall implementation of PIU-BARC Component activities. These committees are: a) Project Implementation Committee (PIC); b) Research Coordination Committee (RCC); c) Core Contractual Staff Recruitment Committee; d) Tender Opening Committee (TOC)/Proposal Opening Committee (POC); e) Tender Opening Committee (TOC), e-GP; f)Tender Evaluation Committee (TEC), e-GP; g) Tender Evaluation Committee (TEC), RFQ; h)Proposal Evaluation Committee (PEC); i) PhD Evaluation Committee; j) PhD Evaluation Committee under PBRG; k) Self Initiative Study visit, Seminar, Workshop, Training Evaluation Committee; and l) Central Monitoring & Evaluation Cell, etc. Each committee has different Terms of Reference (TOR).

Chapter 3

Implementation Progress of CRG and PBRG Sub-projects

3.1: Agricultural Innovation Fund (AIF-1) Management

NATP-2 has already developed an Operational Guideline for Agricultural Innovation Fund (AIF-1) for its efficient management. Bangladesh Agricultural Research Council (BARC) as the lead agency with the NARS and non-NARS (Public Universities, NGOs and other Organizations) institutes has been implementing the research programs on different areas of agriculture all over the country. Under Agricultural Innovation Fund (AIF-1), two types of research programs-(i) Competitive Research Grant (CRG) and (ii) Program Based Research Grant (PBRG) are being implemented. AIF-1 fund is being used to cover the sub-project research and related cost. Selected research proposals are being received 100% AIF -1 fund, maximum limit for each CRG research proposal is BDT 57.58 lakh (US$ 74,300) and maximum limit for each PBRG is BDT 387.50 lakh (US$ 500,000). However, the cost is depends on the size and nature of the proposal.

3.2: Competitive Research Grant (CRG) Sub-projects

The first window of NATP-2 research investment is Competitive Research Grant (CRG) program that promotes demand driven basic, strategic, applied and adaptive research with better research-extension-farmer linkages. Better linkages make new technology more relevant and speed up dissemination. CRG critically targets to mobilize research capacity, stimulate creativity and promote efficiencies in the research system. CRGs are open to all research providers-National Agricultural Research Institutes (NARIs) and non-NARI research providers (Public Universities, NGOs and other Organizations). In the CRG system, research providers are selected on competitive basis using calls for research proposals and subjected them to rigorous review by the peer reviewers before being selected for funding. CRG programs are fully funded through the USAID Trust Fund (TF) which will closes in September 30, 2018. Only those eligible CRGs are considered that effectively complete by that time.

According to operational guideline of AIF-1, PIU-BARC had advertised invitation of Concept Note (CN) for CRG sub-projects on 03 October 2016. After deadline, PIU-BARC received 537 CN for CRG sub-projects.Nine Technical Committees of different Technical Divisions of BARC had reviewed the 537 CN of CRG sub-projects and selected 206 CN for submission of Full Research Proposals. Principal Investigator (PI) of successful CN had submitted their Full Research Proposal (FRP) within scheduled time. Technical Divisions of BARC had prepared independent reviewers panel. According to Project Implementation Manual (PIM), each Full Research Proposal (FRP) was reviewed by two independent reviewers. After rigorous review, Executive Council (EC) of BARC had approved 190 CRG sub-projects with BDT 47.57 crore including GoB BDT 2.40 crore against the targeted 100 CRG sub-projects.

Approximately BDT 12.41 crore of USAID remain unallocated due to short of time. It may be mentioned here that given the delays in start-up to the project, and taking in to consideration that the USAID Trust Fund will closes on September 2018, 1st Implementation Support Mission(ISM) of NATP-2, that took place from December 10-14, 2017 at BARC recommends that the Government request the extension of the USAID Trust Fund (TF) utilization time for one year to complete the implementation of CRG Sub-projects. Accordingly Economic Relations Division (ERD) has requested The World Bank on April 10, 2018 for an extension of USAID Trust Fund (TF) utilization time up to September 2019 to complete the CRG Sub-projects successfully. Allocation of the remaining fund depends on the extension of USAID Trust Fund utilization time.

Awarded and LoA signed 190 CRG sub-projects are being implemented by the twenty seven (27) NARS and non-NARS institutes against the targeted one hundred(100) CRG sub-projects. Institute wise and Division wise list of awarded and LoA signed CRG sub-projects are mentioned in table-1 and table- 2 respectively. Detailed list of CRG sub-projects with title and Principal Investgator's name is furnished in Annex-I.

Table-1: Institute Wise Distribution of 190 CRG Sub-projects

SL. No.	Name of Institute/ Organization	No. of CRG Sub-projects	SL. No.	Name of Institute/ Organization	No.of CRG Sub-projects
NARS			**Universities**		
1.	BARC	04	14.	BAU	32
2.	BARI	41	15.	BSMRAU	10
3.	BRRI	14	16.	SAU (Dhaka)	08
4.	BINA	04	17.	SAU (Sylhet)	15
5.	BJRI	03	18.	CVASU	03
6.	BSRI	05	19.	HSTU	05
7.	BTRI	04	20.	PSTU	07
8.	SRDI	01	21.	DU	03
9.	BSRTI	04	22.	KU	01
10.	BFRI (Fisheries)	06	23.	NSTU	02
11.	BLRI	03	24.	RU	04
12.	BFRI (Forest)	03	**Others**		
13.	CDB	04	25.	NIB	02
			26.	SDA	01
			27.	BFRF	01
				Total	**190**

Table-2: Division/Discipline Wise Distribution of 190 CRG Sub-projects

Sl. No.	Division/Discipline	No. of Sub - projects	Approved Budget (Tk. in Crore)	Average Budget/project (Tk. In Crore)
1	Crops	62	11.23	0.18
2	Fisheries	30	11.03	0.37
3	Livestock	26	5.25	0.20
4	AERS	10	2.36	0.24
5	Planning & Evaluation	10	3.37	0.34
6	Soil	19	5.24	0.28
7	Forest	11	3.02	0.27
8	Agrlcultural Engineering	16	3.88	0.24
9	Nutrition	06	2.19	0.36
	Total	**190**	**47.57**	**0.25**

3.3: Technical Progress of CRG Sub-projects

It may be mentioned here that none of the CRG sub-project has yet been completed. However, discipline wise brief technical progress of CRG sub-projects are mentioned below:

CROPS

1. Sub-project title: Arthropod pests infesting ornamental plants in Bangladesh: Strategies for management (ID- 315)

Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur has been executing the sub-project at Chittagong, Jessore, Narshingdi, Satkhira and Gazipur during April 2017 to September 2018 with the objectives of i) To identify the insect and mite species caused damage to ornamental plants in Bangladesh, ii) To establish relationship between weather factors and pest population dynamics and iii) To develop management tactics of insect and mites in commercial flowers. A total of 51 insect and 4 mite species have been identified as pest of ornamental plants, while thrips, aphid, bud worm and mites have been observed as major pest. Thrips have been identified as major pest of gladiolus, bud worm for thuja, aphid & bud worm for tube rose, aphid for marigold, and mealy bug for dahlia. Pest abundance has been observed highly correlated with weather parameters. Application of different pesticides has showed effective results on the pest management.

2. Sub-project title: Integrated pest management (IPM) approaches to major pests of tea for sustainable tea production (ID- 337)

Insect tolerant clone of tea

The sub-project is being implemented by the Bangladesh Tea Research Institute (BTRI), Srimangal at Srimangal, Moulvibazar and Panchagarh from April 2017 to September 2018 with the objectives of i) To develop integrated pest management (IPM) strategy for sustainable tea production in Bangladesh by incorporating all the suitable methods in a compatible manner for the management of major pests of tea, ii) To introduce a permanent control measures with safety of natural enemies, iii)To reduce the use of synthetic pesticides to keep the surroundings healthy and iv) To minimize the risk of pesticide residue in made tea through utilization of IPM practices. A pest management laboratory with modern scientific equipments and an IPM field laboratory have been established at BTRI Sub-station, Panchgarh. IPM techniques have been developed in tea such as Plucking, Pruning & Field Sanitation as cultural control measures against major pests of tea. Resistant or susceptible clones/agro-types against major pests of tea have been screened out. Solar power light traps, yellow & blue sticky traps as mechanical control measures against major pests of tea have been developed. Garlic plant extracts, Bacillus thuringiensis and commercial bio-pesticides PEAK MOTI & PEAK MONA are found most effective in controlling the red spider mite and looper caterpillar of tea.

3. Sub-project title: Identification of VAM and determination of their potentiality on tea cultivation (ID- 339)

Bangladesh Tea Research Institute (BTRI), Srimangal has been executing the sub-project at the BTRI experimental farm of Srimangal and Moulvibazar during June 2017 to September 2018 with the objectives of i) To find out the VAM (Vesicular Arbuscular Mycorrhiza) from the soil of tea garden and

ii) To determine their colonization potentiality on tea plants. Among the tested 20 plant species, 8 have been found positive for AM association. The highest colonization has been observed in Leucas aspera (60%) followed by Tagetes spp. (35%), Albizzia lebbek (30%), Tripsacum andersonii (20%), Derris robusta (15%), Albizzia odoritissima (15%), Mimosa invisa (15%) and Indigofera teysmannii (10%).Three AM species viz. Glomus, Gigaspora and Scutellospora have been isolated and identified from tea ecosystem. Glomus has been found as dominant AM fungal species associated with the roots of higher plant. A positive correlation between root colonization and AM spore population has been found. No association of AM fungi with the roots of transferred tea saplings has been found in the nursery condition after 30 and 90 days of inoculation.

4. Sub-project title: Determination of residue level of commonly used pesticides in tea (ID- 340)

Bangladesh Tea Research Institute (BTRI), Srimangal has been implementing the sub-project at the BTRI experimental farm and commercial tea estates of Srimangal and Moulvibazar during April 2017 to September 2018 with the objectives of i) To determine the residue of commonly used pesticides in tea, ii) To fix the safe harvest interval of those pesticides in tea and iii) To pin point its status in the sample so that preventive and precautionary measures could be made in time. The residue level of chlorpyrifos for green leaf and made tea have been found 0.164 mg/kg (above MRL of EU) and 0.013mg/kg respectively at 7 DAS while the residue level of quinophos for green leaf and made tea have been observed 0.022 mg/kg and 0.025 mg/kg respectively at 7 and 3 DAS which are below the MRL of EU (0.05). The safe Pre Harvest Interval (PHI) of chlorpyrifos and quinophos has been found 10 and 7 DAS for green leaf of tea.

5. Sub-project title: BTRI clones and improved seeds to the stakeholders (ID- 342)

Bangladesh Tea Research Institute (BTRI) has been conducting the sub-project at the BTRI experimental farm, seven tea gardens of greater Sylhet and three tea gardens of North Bengal during June 2017 to September 2018 with the objectives of i) Establishment of zonal nurseries under BTRI and local garden collaboration, ii) To support tea estates with particular emphasis on less developed tea estates and iii) To improve the national production as well as quality of Bangladesh tea. Two nucleus clone plot (NCP) have been established in Madhabpur T.E. and Patrokhola T.E.Planting materials have been supplied to Jagcherra T.E., Chatlapure T.E. and Luani-hollycherra T.E. for establishing seedbari.A nursery has been established in which a total number of 8800 plantlets of different improved cultivars e.g. BT1, BT9, BT11, BT12, BT13, BT15, BT16, BT17, B207/39 and TV1 have been raised for further supplying to the tea estates for establishing NCP and Seedbari.

6. Sub-project title: Productivity enhancement of promising vegetable varieties during winter and summer in Sylhet Region (ID- 345)

The sub-project is being implemented by the Sylhet Agricultural University (SAU), Sylhet at the campus of SAU and farmers field of Sylhet during April 2017 to September 2018 with the objectives of i) To identify suitable vegetable variety(s) and production technologies for Sylhet region, ii) To popularize suitable vegetable variety(s) and production technologies in Sylhet region and iii) To improve the knowledge and skill of farmers for vegetable production in Sylhet region. For summer season country bean production, “Sikribi sheem-1” has been found most suitable (9.88-12.35 t/ha) in Sylhet region. Production of summer tomato in Sylhet region using grafted tomato seedling has been observed more productive (55 t/ha) compared to non-grafted seedling (28 t/ha). BARI Hybrid tomato-5 has been found more productive (94 t/ha) in Sylhet region in comparison to other commercial variety during winter. Production of broccoli in Sylhet region has been found promising (22.23-27.17 t/ha) and profitable. BARI Jharsheem-1 has been observed very productive at October (19.0 t/ha) and November (18.53 t/ha) sowing compared to other genotypes.

7. Sub-project title: Morpho-molecular characterization of underutilized indigenous vegetables in Bangladesh (ID- 368)

The sub-project is being executed by the Bangladesh Agricultural University (BAU), Mymensingh at the Department of Biotechnology and Germplasm Centre of BAU (BAU-GPC) for the period from May 2017 to September 2018 with the objectives of i) Collection and conservation of important underutilized vegetables, ii) Documentation of their phenotypic characteristics and iii) Documentation of their molecular characteristics using DNA markers. Eighteen drumstick (Moringa sp.), 15 pigeon

A view of roselle plant at BAU, Mymensingh

pea (Cajanus cajan L.), 3 roselle (Hibiscus sabdariffa var. sabdariffa L.) and 2 wild teasle gourd (Momordica cochinchinensis) (Lour.) germplasm have been collected. Morphological characteristics like plant height, leaf, rachis, flower, fruit and seed characters of the collected moringa, pigeon pea, roselle and wild teasle gourd have been recorded. Genomic DNA from 18 moringa, 60 (15x4) pigeon pea, 12 (3x4) roselle and 8 (2x4) wild teasle gourd plants have been isolated.

8. Sub-project title: Development of sustainable biological weed management techniques through allelo-chemicals from crop residues (ID- 369)

Bangladesh Agricultural University (BAU), Mymensingh has been conducting the sub-project at its Department of Agronomy from May 2017 to September 2018 with the objectives of i) To screen out potential crop residues for allelochemicals, ii) To explore the possibility of using allelopathic properties of crop residues for weed suppression, iii) To study the dose response and time of application of selected crop residues for crop performance and iv) To improve the existing organic matter status of the soil. Ten different crop residues eg.Grass pea, mustard, pea, barley, sunflower, lentil, sorghum, wheat, soybean and rice have been screened out based on potentiality of

allelo-chemicals. The trend of inhibition in the pot have been observed as Sorghum> Lentil> Grass pea >Sunflower > Mustard > Rice > Barley > Wheat > Acacia > Soybean. The trend of inhibition in the aqueous extracts have been found as Sorghum> Lentil> Grass pea >Sunflower > Marshpepper > Mustard > Rice > Barley > Wheat > Acacia > Soybean. Aqueous extracts of sorghum crop residues 1: 2 ratio (w/v) inhibited 51.81 % Bathua, 51.10% Mutha, 52.90% Durba, 53.85% Shama, 73.83% Tit begun, 55.58% Biskatali and 75.26% Angta. Aqueous extracts of mustard crop residues 1: 2 ratio (w/v) inhibited 66.32 % Bathua, 60.98% Mutha, 73.90% Durba, 66.40% Shama, 67.65% Tit begun, 67.52% Biskatali and 67.36% Angta. Aqueous extract of allelopathic potential crop residues like sorghum, mustard, grass pea, lentil etc. could be a prospective source of weed control agent for crop production in modern agricultural science.

9. Sub-project title: Adaption of a new species "Tomatillo (Physalis phyladelphica Lam./Physalis ixocarpa Brot) (ID- 376)

Sher-e-Bangla Agricultural University, Dhaka has been implementing the sub-project at Rangpur, Madhupur and Noakhali for the period from April 2017 to September 2018 with the objectives of i) On-farm research trials of tomatillo based on agro-morphogenic traits, ii) Biochemical analysis of tomatillo based on nutritional and antioxidant traits and iii) Screening and physiological analysis of tomatillo against salt and drought stress. Adaption of a new crop species "Tomatillo" which is an eco-friendly (no pesticides are required) and short- durated (85-90 days) crop has been done. Two previously released varieties of tomatillo (SAU tomatillo 1 and SAU tomatillo 2) have been disseminated to the farmers' at three agro-ecological zones of Bangladesh. A third line of tomatillo (PI 003) has been found promising for variety registration.

10. Sub-project title: Characterization and documentation of minor fruits in Bangladesh with special emphasis on coastal and hilly areas (ID- 384)

Bangladesh Agricultural University (BAU), Mymensingh has been conducting the sub-project at BAU-GPC for the period of May 2017 to September 2018 with the objectives of i) To collect and conserve the important minor fruits from coastal and hilly areas of Bangladesh, ii) To characterize the physio-morphological features and nutritional status of collected minor fruits from coastal and hilly areas of Bangladesh and iii) To document the information for future use in varietal improvement also protect these local landraces from piracy. Collection and conservation of selected minor fruits from coastal and hilly areas of Bangladesh have been completed. Morphological characterization and nutritional status of all the selected minor fruits have been completed. Five Monkey jack, eight Velvetapple, four Cowa, three Riverebony and one each of Governor's plum, Lukluki and Gutguti genotypes have been identified.

11. Sub-project title: Oxidative stress tolerance of maize under drought and salinity: Mechanism and identification of stress inducible proteins (ID- 389)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at its molecular breeding lab for the duration from April 2017 to September 2018 with the objectives of i) Understanding oxidative stress tolerance in maize at physiological, biochemical and molecular level in contrast maize genotypes in relation to tolerance to drought and salinity, ii) Protocol development for expression of inducible protein and related transcript and iii) Identification of important inducible protein under drought and salinity tolerance for further biotechnological work. In-gel activity protocol of SOD (Superoxide dismutase), POD (Peroxidase), CAT (Catalase), APX (Ascorbate peroxidise), GPX (Glutathione peroxidise) and GR (Glutathione reductase) have been developed.Activity assay protocol of enzymes under anaerobic conditions like ADH (Alcohol

dehydrogenase), PDC (Pyruvate dehydrogenase) and LDH (Lactate dehydrogenase) which have shown 10 times economic than the existing ones.CAT3, APX1 and APX2 have been identified as responsive protein under salinity. CAT1, CAT2, CAT3 and GPX2 have been found important for drought tolerant.

12. Sub-project title: Evaluation of endocrine bio- pesticides against major sucking insect pests of vegetables (ID- 400)

Bangladesh Agricultural Universitry (BAU), Mymensingh has been conducting the sub-project at Mymensingh during the period from May 2017 to September 2018 with the objectives of i) To evaluate the potentialities of endocrine biopesticides on the inhibition of growth and development as well as mortality of different sucking insects in the laboratory condition, ii) To investigate the field efficacy of selected endocrine biopesticides on the mean populations, percent reduction of population over control, abundances of natural enemies in vegetable-ecosystem and marketable yield of selected vegetables and iii) Identification of effective endocrine biopesticide/s based on laboratory and field screening for managing the major sucking insect pests of vegetables as viable replacement of conventional and broad-spectrum insecticides. About 80 to 85% sucking insect populations (aphid, jassid, white fly) have been reduced due to the application of bio-pesticides like Buprofezin (Award 40 SC), Lufenuron (Heron 5 EC) and Pyriproxifen (Pyrifen 10.8EC). Chitosan has been found to be ineffective against sucking insects and this result has been observed consistent with laboratory findings. Initially, the action has been found to be slower but increased gradually. Infested or curled leaves (%) have been reduced potentially following treated with selected endocrine bio-pesticides. Endocrine bio- pesticides have been found to be safe for natural enemies in vegetable eco-system.

A view of pot experiment at BAU

13. Sub-project title: Assessment of ecosystem services and benefits of roof top gardening for climate-friendly city development using geospatial technology (ID- 413)

The sub-project is being carried out by the Sher-e-Bangla Agricultural University, Dhaka at the selected wards of Mohammadpur and Dhanmondi areas of Dhaka North and Dhaka South City Corporatin for the duration of April 2017 to September 2018 with the objectives of i) To identify existing plant species diversity of selected household rooftops of the study area, ii) To assess the benefits of rooftop gardens in providing thermal comfort and ecosystem services and iii) To investigate and identify suitable vegetable and flower species for rooftop gardening through demonstration. About 65% RTG (rooftop garden) owners of selected areas has been harvested 21-40 kg of various products/year. Dhaka City rooftop gardens have possessed high species diversity (Shannon Weaver Diversity Index-4.51) and high interspecies diversity. About 90% RTG owners have been consumed fresh products from their rooftop garden while only 9% RTG owners have been sold their products in the local markets. The survey result showed that the air temperature has been reduced by 5.2^{0}C as compared to bare roof. About 30% RTG owners have felt thermal comfort in their room as compared to without garden.

14. Sub-project title: Tobacco replacement through high value and nutrient rich crops for food security and nutrition of char land people under Bhuapur upazilla of Tangail (ID- 440)

Bangladesh Agricultural Research Institute (BARI) has been conducting the sub-project at the two different villages of two different unions (Char land area) under Bhuapur upazilla of Tangail for the duration of April 2017 to September 2018 with the objectives of i) To ensure food security and nutrition for charland people by replacement of tobacco with high value and nutrient rich crops, ii) To increase productivity, income and change livelihood by adaptation and dissemination of high value and nutrient rich crops against tobacco and iii) To develop skill, knowledge and awareness of the farmers. Black cumin, chilli, bottle gourd, sweet gourd, groundnut, wheat and maize have provided more profits (97.13 to 740.41%) and nutrition against tobacco. Black cumin, chilli and bottle gourd could easily be fitted in existing T. aman- Tobacco- Jute/Sesame cropping pattern which can replace tobacco. Additional application of gypsum fertilizer (37 kg/ha) with modern cultivation practices (including irrigation) after flowering stage of groundnut has produced higher yield (54.66%) than the traditional cultivation practices. BARI Gom-26, BARI Gom-28, BARI Gom-30, BARI Gom-33, BARI Hybrid Maize-7, BARI Hybrid Maize-9, BARI Chinabadam-8, BARI Chinabadam-9, BARI Chinabadam-10, BARI Kalozira-1 may be recommended for char land farmers due to their higher yield and more economic return. Due to higher yield and market price char land farmers would be benefited economically and ensured food security which would improved their livelihood and discourage them tobacco cultivation.

15. Sub-project title: Effect of different fruit bagging materials on the production of quality and safe mango (ID- 444)

Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur has been conducting the sub-project at the different mango orchards around HSTU for the duration of April 2017 to September 2018 with the objectives of i) To control the pest and diseases of mango by applying minimum pesticide, ii) To investigate the effect of bagging materials on the fruit development, physico-chemical- compositions and shelf- life extension of mango and iii) To create awareness of the mango growers through training and increase the production of exportable safe mango. Brown paper bag has been found the best in respect of physico- chemical and microbial parameters of mango in comparison to polythene and white paper bag. The usage of pesticides has been reduced. Pest and diseases free safe mango has been produced. Quality of bagging mangoes has been almost unchanged. Some mango growers have been adopting bagging technology.

view of mango fruit bagging practices at Dinajpur

16. Sub-project title: Molecular identification of the tomato leaf curl virus (ToLCV) resistant/ tolerant tomato lines (ID- 451)

The sub-project is being conducted by the University of Dhaka (DU), Dhaka at its Plant Breeding and Biotechnology Lab. for the period from April 2017 to September 2018 with the objectives of i) Screening of tomato leaf curl virus (ToLCV) resistant/tolerant germplasm through rolling circle

amplification (RCA) analysis, ii) Identification of the resistant/tolerant lines using molecular markers (SSR) linked to ToLCV resistance/tolerance and iii) Molecular confirmation of the ToLCV resistance/tolerance by agro-inoculation of the ToLCV infectious clone into the promising tomato lines. Twenty one lines from eight germplasm have been found to be completely resistant against ToLCV in both field and molecular observation. Three lines from eight tomato local germplasm have been found to be tolerant against tomato leaf curl virus and other lines have been observed to be susceptible. Five promising lines have been identified that could be used as donor parents in breeding program.BLAST results of the sequence has confirmed the presence of Ty genes in those five selected lines.

17. Sub-project title: Effectiveness of non-chlorine sanitizers in improving the safety and quality of high value exportable fresh betel leaf (ID- 452)

The sub-project is being conducted by the University of Dhaka (DU), Dhaka at Barisal, Kushtia and Jhenaidah for the period from April 2017 to September 2018 with the objectives of i) To identify the point of contamination during production and processing in the project area and recommend the best safety practices during betel leaf production and processing, ii) To evaluate the use of non-chlorine sanitizers against food borne pathogen during postharvest processing to improve the quality and safety of betel leaf and iii) To introduce hygiene and sanitation in strengthening postharvest management of the project beneficiaries in value chain of betel leaf. Safe betel leaf production practices at field level have been developed. Non-chlorine sanitizers and washing practices to eliminate pathogens from betel leaf surfaces at commercial level have been developed. Low cost hygiene improvement materials to improve personal hygiene practices of farmers at the field level have been introduced.

View of non-chlorine sanitizers practices in betel leaf at Jhenaidah

18. Sub-project title: Selection of salt tolerant sunflower and mustard genotypes based on physiological and biochemical traits (ID- 459)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been conducting the sub-project at its Central Laboratory of Oilseed Researh Centre for the duration of April 2017 to September 2018 with the objectives of i) To select salt tolerant genotypes of sunflower and mustard for the coastal area of Bangladesh, ii) To determine the physiological mechanism of salt tolerant sunflower and mustard genotypes and iii) To determine biochemical characterization of sunflower and mustard genotypes and their oil quality in relation to salt stress. Two sunflower (BD-4017 & BARI Surzumukhi -2) and three mustard (BD-10115, Jun-405336 & BARI Sarisha-16) genotypes were selected under salinity based on the physiological and bio-chemical traits. In comparison with the salt tolerant cultivar (Hysan), selected sunflower & mustard genotypes have higher or similar trends of physio-biochemical changes and anti-oxidant enzymes activities and have showed the better tolerance performance to the salt sensitive cultivars. SOD1, SOD2, CAT1, CAT2, APX2, APX3, POD1 & POD3 have been observed the responsive protein under salt stress.

19. Sub-project title: Validation and up scaling of fresh cut fruits and vegetables processing technologies (ID- 465)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been executing the sub-project at the postharvest laboratory of HRC for the duration of April 2017 to September 2018 with the objectives of i) To know the existing situation of fresh cut fruits and vegetables in Bangladesh, ii) To study the use of sanitizer, safe food additives, edible coating and packaging of fresh cut fruits and vegetables to

View of fresh cut vegetables packed in LDPE bag at BARI

extend the shelf life with quality and iii) To determine the microbial load and storage potential of fresh cut fruits and vegetables for safe products. Demand of fresh cut fruits and vegetables have been increasing in the city especially in Dhaka. Fresh cut (FC) control carrot (no heat treatment) stored in refrigerator has been found acceptable up to 4 days where as carrot treated with warm solution of 2% NaCl kept in PP box has been observed good up to 8 days while carrot treated with warm solution of 2% citric acid has been found good more than 10 days. Fresh cut (FC) cauliflower packed in perforated LDPE bag, sealed LDPE bag, PP box and cling wrapped stored in refrigerator has been observed acceptable up to 16 days while vacuum packed cauliflower has been found acceptable more than 20 days. Fresh cut pineapple washed with sanitizers (2% citric acid solution, 200 ppm sodium hypochlorite) stored in refrigerator has been observed good up to 6 days and without wash has been found good up to 5 days whereas tap water washed pineapple has been observed good up to 4 days.Fresh cut jackfruit bulb washed with sanitizers (2% citric acid solution, 200 ppm sodium hypochlorite) stored in refrigerator has been found good up to 12 day and bulb without wash has been observed good up to 9 days while bulb washed with tap water has been found good up to 6 days.

20. Sub-project title: Status of insect biodiversity and ecosystem functions in tea estates of the Sylhet region (ID- 474)

The sub-project is being conducted by the Sylhet Agricultural University (SAU), Sylhet at Sylhet Sadar upazilla for the period from April 2017 to September 2018 with the objectives of i) To determine variations in insect biodiversity among four microhabitat types in tea estates, ii) To determine

relationships of various functional groups of insects with understory vegetation and microclimatic changes in tea estates and iii) To recommend biodiversity conservation and management strategy for the tea estates. Variations in microclimatic conditions (i.e., temperature, relative humidity, dew point, light intensity, etc.) of four microclimatic habitats have been recorded. Variations in abundance of tea bush (as understory vegetation) of four microclimatic habitats have been recorded. Arthropods (Insecta) samples of eight collection dates have been identified. Relative abundance of pest, beneficial and mixed group has been determined.

21. Sub-project title: Survey, monitoring and eco-friendly integrated management of major insect pest and disease in chilli at Jamalpur Region (ID- 477)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at different upazillas of Jamalpur for the duration of April 2017 to September 2018 with the objectives of i) To find out the major insect pest (s) and disease (s) in chilli and their management approaches, ii) To motivate the chilli framers for controlling major pest (s) and quick dissemination of new IPM technologies among them and iii) To reduce the indiscriminate use of pesticides and ensuring food security. Some sucking pests (thrips and mite), borer complex (Spodoptera litura and Helicoverpa armigera) and diseases (Fusarium wilt, Bacterial wilt and Choanephora) have been identified as barrier of chilli production. Spraying of Spinosad (Success 2.5SC) and Abamectin (Toximite 1.8EC) along with blue & yellow sticky traps has been found effective for controlling sucking insect pest of chilli. Mass trapping of Spodoptera litura and Helicoverpa armigera + spraying of SNPV and HNPV along with Spinosad (Success 2.5SC) has been found effective for controlling borer complex of chilli. Alternate spraying of Carbendazim (Autostin) and Pyraclostrobin+Metiram (Carbio Top) along with seed treatment has been found effective for controlling wilt disease of chilli. Spraying of Tebuconazol+Trifloxistrobin (Nativo) @ 0.6g/l of water has been found effective for controlling anthracnose and choanephora disease of chilli.

Partial view fresh chilli field at Jamalpur

22. Sub-project title: Collection, evaluation, characterization and bulb preservation of lilium in Bangladesh (ID- 479)

Parlial view of lilium field at BARI, Gazipur

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at the experimental field of Floriculture Division, HRC for the period from April 2017 to September 2018 with the objectives of i) To collect lilium germplasm from different sources, ii) To evaluate the performance of lilium under the climatic condition of Bangladesh and iii) To find out the suitable method for preserving lilium bulb. Nineteen (19) attractive coloured lilium germplasm have been collected. Among them, 14 and 05 genotypes have been found

suitable for cut flower and pot culture respectively. One genotype Lil-001 has been found to be cultivated under different shade (UV poly film and shade net) and open condition. Both Asiatic and Oriental lilium could be cultivated in Bangladesh successfully.

23. Sub-project title: Crop productivity enhancement through agronomic practices in Sylhet region (ID- 490)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at Sylhet, Moulvibazar, Habigonj and Sunamgonj for the period from April 2017 to September 2018 with the objectives of i) To increase cropping intensity and crop productivity through introduction of new varieties of pulses, oilseeds, wheat and other upland crops during rabi season in Sylhet region under limited water condition. ii) To increase individual crop yield and system productivity through soil, water, fertilizer and crop management practices and iii) To facilitate adoption of improved technology in the project area for increasing crop production. BARI Sarisha-14 and BARI Sarisha-15 have produced higher yield under limited water condition. BARI Mashur-8 has performed better in relay cropping with T.aman rice under residual soil moisture. Liming @1.5 t/ha has increased grain yield of wheat.BARI Gom-28(4.2 t/ha), BARI Gom-31(4.1 t/ha), BARI Hybrid Maize-9(7.87 t/ha) have produced higher yield under residual soil moisture conditions.Mustard, Mungbean and Wheat have grown successfully in T.aus-T.aman cropping pattern in Sylhet region and total productivity and profitability have increased considerably over existing farmers practice.

24. Sub-project title: Risk assessment and development of management approach(s) against tomato leaf miner, Tuta Absoluta (ID- 504)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at Gazipur, Comilla and Panchgarh for the duration of April 2017 to September 2018 with the objectives of i) To findout severity and critical time of attack of the Tuta absoluta on tomato, ii) To develop an effective management approach (s) of tomato leaf minor and iii) To demonstrate the impact of best management approach of tomato leaf minor in terms of yield and net income and motivate the farmers to adopt this technology through field day and training/workshop. Among five locations, the highest and lowest infestation of tomato leaf miner Tuta absoluta has been observed at Panchgarh and Comilla respectively. The peak period of Tuta attack has been observed in the month of March- April in winter and May-June in summer season. The population of this pest has been observed higher during summer season than that of winter season. The Tuta population has been found positively correlated with the temperature, % relative humidity and rainfall (mm). Application of Metarrhizium anisolpiae bio-pesticide in soil @ 5g/l of water + Foliar spray of Azadirachtin (Bio-Neem plus1 EC @1ml/l of water) + Mass trapping through placement of Delta sex pheromone trap has showed the best performance considering the reduction of Tuta infestation, increase of marketable yield and maximum marginal benefit cost ratio.

25. Sub-project title: Identification of different species of bacteria causing bacterial diseases of silkworm (Bombyxmori) L. and their control (ID- 518)

The sub-project is being implemented by the Bangladesh Sericulture Research and Training Institute (BSRTI), Rajshahi at its field and laboratory for the period from April 2017 to September 2018 with the objectives of i) Study on different bacterial species, ii) Study on relationship between host and pathogen and iii) Study on effective chemicals to control bacterial diseases. Some bacteria like Streptococcus sp.Staphylococcus sp. and Bacilli sp. have been isolated and bio-chemically tested from the infected silkworm. The relationship between host and pathogen incidence has been observed high during the period from May-September at the high temperature or high humidity.Bleaching powder, Para formaldehyde, Ammonia. Benzoic Acid, Calcium carbonate, and Sodium carbonate have found potential to control the bacterial diseases.

26. Sub-project title: Studies on the species complex and their bio-rational based management of fruit flies infesting fruits and vegetables in Bangladesh (ID- 526)

Goava fruit fly management technique through pheromone trap

Bangladesh Agricultural Research Institute (BARI), Gazipur has been conducting the sub-project at Gazipur, Jessore, Chapainawabgonj, Rangpur, Jamalpur, Barishal and Khagrachari for the period from April 2017 to September 2018 with the objectives of i) Identification and documentation of species composition of fruit flies infesting fruits and vegetables using morphometric and molecular tools, ii) Development of bio-rational based management options of different fruit fly species and iii) Field validation of the developed technologies in the farmer's field. Among the four major species group viz. Bactroera dorsalis (13 isolates), B. tau (8 isolates), B. cucurbitae (4 isolates), and B. scutellata (2 isolates); three group viz. Bactroera dorsalis, B. tau and B. cucurbitae have been found the most prevalent.Ceratitis capitata, which is popularly known as Mediterranean fruit fly (Medfly) is one of the world's most destructive fruit pest has been collected and morphologically identified from Rahmatpur, Barishal. However, through COI sequencing it has been identified as Bactroera tau. Sanitation + pheromone mass trapping followed by sanitation + attract & kill method has been found very much effective against cucurbit fruit fly, while sanitation + attract & kill method has been observed effectively control fruit fly complex in different fruit crops.

27. Sub-project title: Up-scaling of lac production technologies for poverty reduction of the ultra poor and marginal farmers (ID- 528)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been implementing the sub-project at Chapainawabgonj, Jamalpur and Gazipur for the duration of April 2017 to September 2018 with the objectives of i) Development of management packages to address biotic and abiotic stresses of lac cultivation at the targeted locations, ii) Field validation of the developed technologies and expansion of lac cultivation in promising areas of the country involving ultra-poor and marginal farmers and iii) Awareness development of lac growers, extension personnel and related consumers on the developed technologies as well as different aspects of lac cultivation for the improvement of lac industry. Apple kul and BAU kul have been found as good hosts of lac at Jamalpur region while Sirish & Babla have produced good yield of lac both at Nachole & Chapainawabgonj. Lac production efficacy of ber has been found better at Jamalpur region next to Chapainawabgonj. Both of Eublemma amabilis and Pseudohypatopa pulverea have been observed the major pest of lac at all of four locations. Spraying of Neem seed extract and Azadirachtin have reduced the predator population effectively and increased lac yield. Basal application of water has reduced lac insect mortality during extreme hot weather condition in Barind area resulting in increased lac yield.

28. Sub-project title: Determination of adulteration of commonly used pesticides and their left over residue in major fruits and vegetables (ID- 529)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been conducting the sub-project at Gazipur, Narsingdhi, Comilla, Bogura and Jamalpur for the period of April 2017 to September 2018 with the objectives of i) To determine the level of pesticide residues remain in fresh fruits and vegetables collected from different markets of Bangladesh, ii) To determine the Pre-Harvest Interval (PHI) of the selected pesticides in major vegetables collected from supervised field trials

and iii) To check adulteration of the commonly used pesticides collected from different locations of Bangladesh. Out of 250 analyzed vegetable samples (viz. yard long bean, hyacinth bean, cauliflower, bitter gourd and brinjal), 33 samples (13.2%) have been found contaminated with chlorpyriphos, diazinon, acephate, quinalphos and dimethoate residues while 217 samples (86.8%) have been found contained no detectable residue of the sought pesticides. Among the 33 contaminated samples, 28 has been observed (11.2%) above the MRL with chlorpyriphos, diazinon, acephate, quinalphos and dimethoate residues. Out of 60 analyzed mango samples, 3 have been found contained cypermethrin residues (0.063mg/kg, 0.085 mg/kg and 0.280mg/kg) collected from Rajshahi and Ishurdi while 1 has been found contained dimethoate residue (0.192 mg/kg) collected from Rajshahi, which has been found above MRL. Out of 60 litchi samples, 2 have been observed contained cypermethrin residues (0.056 mg/kg, and 0.074 mg/kg) collected from Rajshahi and Ishurdi and 1 has been found contained chlorpyrifos residue (0.127 mg/kg) collected from Ishurdi, which has been found above MRL. Four supervised field trials have been conducted with recommended dose of fenvalerate (1ml/l of water) and dimethoate (2ml/l of water) in tomato and hyacinth bean. The PHI has been found 10 days after spray (DAS) in tomato and 14 DAS in hyacinth bean while for dimethoate 10 DAS in tomato and 12 DAS in hyacinth bean. Around 71% marketed brands of tested pesticides (cypermethrin, carbofuran, diazinon, dimethoate, chlorpyriphos and quinalphos) have been found pure in terms of AI presence. In addition, 12% of the tested brands have been found between 80%-90% pure while14% of the tested marketed pesticides have been observed equal or below 80% pure and the remaining around 3% brand has been found sub-standard level (≤ 50%) of purity which has supported the claim of overusing pesticides due to impurities. Pesticides collected from Bogura (50% a.i in chlorpyriphos) and Comilla (26% a.i in cypermethrin) have showed more impurities than other region.

29. Sub-project title: Development of production package with special emphasis on off season flowering of dragon fruit (ID- 538)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been executing the sub-project at Narsingdi, Gazipur and Rangamati (Raikhali) for the period from June 2017 to September 2018 with the objectives of i) To develop off season production technique of dragon fruit and ii) To standardize a production package of dragon fruit cultivation. Off-season production of dragon fruit has been made possible by manipulating the environment through artificial lighting using 100-watt incandescent bulb (normal bulb), 20-watt LED (Light Emitting Diode) bulbs or 36-watt CFL (Compact Fluorescent Lamps). Irrespective of time cutting length has been observed important for dragon fruit propagation. The longer cuttings have showed superiority over shorter cuttings. The cuttings prepared with 30 cm length have performed better followed by cuttings of 20 cm length in all the growth parameters. But considering number of propagule 20 cm length has been found suitable. Higher doses of fertilizers have been observed positive effect on plant growth and reproductive behavior compared to control (no fertilizer). 250 % of the fertilizer dose (540g N, 315g P and250g $k_2$0) applied in three to four split application has been found suitable considering growth, flowering and fruiting of dragon fruit. Fruits of BARI Dragon fruit-1 have been reached physiological maturity at 28 DAA. At this stage of maturity, fruit has attained 250 g in weight in an average having light pinkish colour. Moreover, fruit has contained 12.2% TSS, 78.45 mg/100g of vitamin-C and 5.58 µg/100g of β Carotene, which are the important quality attribute of fresh fruit. Besides, shelf life of fruits has been observed 14 days at ambient condition.

30. Sub-project title: Testing of cotton cultivation technology in the drought prone area of Barind tract of Bangladesh (ID- 583)

Cotton Development Board (CDB), Dhaka has been conducting the sub-project at Rajshahi, Naogaon, Natore, Joypurhat, Rangpur and Dinajpur for the duration of June 2017 to September 2018 with the objectives of i) To asses the adaptability of cotton varieties suitable for drought prone areas, ii) To

determine optimum sowing time for drought prone area and iii) To investigate the impact of mulching on cotton production in the Barind tract. The highest seed cotton yield (3.23 t/ha) has been obtained from 10 July sowing followed by 25 July (3.14 t/ha) and the lowest seed cotton yield (2.81 t/ha) has been produced in 10 August sowing. Straw mulch has produced higher seed cotton yield (3.13 t/ha) than no straw mulch (2.99 t/ha) but straw mulch has not positive effect on lint quality. Different locations of Barind have been found effect on seed cotton yield and lint characters. Straw mulch could not affected the lint quality.

31. Sub-project title: Development of eco-friendly management of sucking insects of cotton (ID- 584)

The sub-project is being implemented by the Cotton Development Board (CDB), Dhaka at Gazipur, Dinajpur, Jessore, Rangpur and Bandarban for the period from July 2017 to September 2018 with the objectives of i) To develop suitable sucking insect-pest management practices under climate change and ii) To reduce dependency on chemical approaches. Application of Azadiractin (Bioneem plus 1% EC) @ 1 ml/ L of water) + Spinosad (Success 2.5 SC) @ 1 ml / litre of water) + Yellow sticky trap has been found effective against jassid population. Application of Azadiractin (Bioneem plus 1% EC) @1ml/litre of water) + Yellow sticky trap has been observed effective for controlling white fly population.

View of management of cotton sucking insects through yellow sticky trap

32. Sub-project title: Collection and molecular characterization of resurged phytopathogen Sclerotinia sclerotiorum causing white mold disease of different crops and its integrated management (ID-599)

The sub-project is being conducted by the Bangladesh Agricultural Research Institute (BARI), Gazipur at Gazipur, Rangpur, Ishurdi and Jamalpur for the duration of April 2017 to September 2018 with the objectives of i) Characterization and study of the nature of *S. sclerotiorum* collected from different hosts through cultural,morpho-physiology and pathogenicity test, ii) Molecular characterization and determination of genetic variability of the collected isolates of *S. sclerotiorum* and iii) Development of eco-friendly package for controlling the white mold disease through integrated approaches for safe production of selected crops. A total of 180 isolates of S.sclerotiorum have been collected, isolated and maintained as pure culture or sclerotia stock at the Plant Pathology Lab., BARI,Gazipur.Morphological characterization of all the isolates have indicated that mycelia growth and sclerotial formation have been varied among the isolates ranging from 2.65cm to 8.10cm at 72 hrs and 9 to 64 sclerotia/petri dish respectively.Molecular characterization of the14 isolates (out of 180 isolates) by ITS sequencing has indicated that all of the tested isolates have been identified as publicly available *S. sclerotiorum*.Phylogenetic analysis of the 14 isolates based on ITS sequences has revealed that the isolates have belonged to a similar group of publicly available S. sclerotiorum and dissimilar with the group of S.minor, S.trifolium and distinctly differ from S.nivalis group.Integration of saw dust burning + soil amendments with *Trichoderma* based bio-fungicide + bacillus based bio-control agents + application of fungicide Rovral 50 WP has been found the best treatment in reduction of white mold disease and increasing plant growth as well as yield of mustard, bush bean and garden pea.Application of only fungicide Rovral 50 WP has also performed better in reducing white mold disease(73.07% in musard, 73.58% in bush bean, 70% in garden pea) increasing plant growth as well as yield of mustard (42.63%) , bush bean (20.41%) and garden pea (35.01%) than the control.

33. Sub-project title: Molecular characterization and integrated management of cucumber mosaic virus infecting cucumber (Cucumis sativus) in Bangladesh (ID- 601)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been implementing the sub-project at the research field and laboratory of BARI for the period from April 2017 to September 2018 with the objectives of i) Proper detection of cucumber mosaic virus strain(s) infecting cucumber in Bangladesh using molecular tools, ii) Study the virus-vector relationship in development of viral disease in the

View of management of cucumber mosaic virus at BARI

cucumber field and iii) To develop potential management options for minimizing CMV infection through integrated approach. Occurrence of cucumber mosaic virus (CMV) (10.75-28.5%) in major cucumber growing areas of Bangladesh has been observed. Five CMV biotypes like mild mosaic, mosaic, mosaic & stunting, mosaic & curling and leaf narrowing have been identified by DAS-ELISA, EM and RT-PCR. Strong positive correlation has been observed in developing CMV disease in the cucumber field with the aphid population. Management package against CMV of cucumber has been developed (Integration of netting seedling, sticky yellow trap, polythene mulch and 4 sprays of Imidacloprid/Bioneem at 15 days interval has been found effectively reduced CMV incidence and increased the yield of cucumber).

34. Sub-project title: Standardization of Trichoderma fortified compost for growth promotion and eco-friendly management of tomato diseases (ID- 605)

Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur has been conducting the sub-project at the research field of BSMRAU, Comilla, Chittagong, Jessore and Bogra for the period from April 2017 to September 2018 with the objectives of i) To collect, isolate and identify and to select the most antagonist isolate of Trichoderma against the major soil-borne and

seed-borne fungal pathogens of vegetables including tomato and screening of Trichoderma against major fungal pathogens, ii)To optimize the composting materials and the dose and substrate of Trichoderma to mix with the Trichoderma fortified compost and iii)To assess Trichoderma fortified compost in controlling soil-borne and seed-borne fungal diseases of tomato and as plant growth promoting microbe (PGPM) in growth promotion and yield of tomato. 100 isolates of antagonist fungi Trichoderma harzianum and 20 isolates of pathogenic soil-borne fungi Rhizoctonia solani, 20 Sclerotium rolfsii, 10 isolates of Fusarium oxysporum f. sp.lycopersici have been collected, isolated and identified. Highly antagonist isolate of Trichoderma harzianum Pb-22, Pb-24 and Com-7 have been selected against different soil-borne fungal pathogen. Poultry refuges have been selected as the most compatible compost to fortify with Trichoderma harzianum colonized with wheat grain. Standard dose of poultry refuges to mix with wheat grain colonized Trichoderma harzianum has been selected.

35. Sub-project title: Distribution, severity, species diversity and damage assessment of papaya mealy bug (ID- 613)

The sub-project is being implemented by the Sher-e-Bangla Agricultural University (SAU), Dhaka at Dhaka, Gazipur,Tangail, Narshingdi, Rajshahi, Bogura, Joypurhat, Natore, Pabna and Jessore for the period from April 2017 to September 2018 with the objectives of i) To know the distribution of papaya mealybug in Bangladesh, ii) To determine the damage severity of papaya mealybug in major papaya growing districts of Bangladesh, iii) To know the species diversity of papaya mealybug in Bangladesh and iv) To assess the extent of loss caused by papaya mealybug. Papaya mealy bug has been found in ten surveyed papaya growing region in Bangladesh. Papaya mealy bug has been observed a major insect pest causing high intensity of damage (61.99% to 75.98% in fruit). All collected species have been found as *Paracoccus marginatus*.

36. Sub-project title: Rooftop gardening: An initiative to spread urban horticulture with changing environment (ID- 623)

The sub-project is being implemented by the Sher-e-Bangla Agricultural University (SAU), Dhaka at its Department of Agricultural Botany for the duration of July 2017 to September 2018 with the

View of roof top gardening at Dhaka

objectives of i) To develop a rooftop garden model to increase the intensity of rooftop gardening in the Dhaka city for the conservation of environment, ii) To identify the suitable plant growing structures and growing media in support of *kharif* season's vegetable crops, brinjal and/or chilli for the rooftop garden and iii) To identify the suitable plant growing structures and growing media in support of *rabi* season's vegetable crops, capsicum and/or tomato for the rooftop garden. Rooftop garden has reduced both roof upper and lower surface temperature in comparison to bare roof. Oxygen percent has been observed higher where as carbon dioxide (CO_2) concentration has been found lower in the garden than the bare roof indicating the contribution of roof gardening in conserving environment with changing climate.Both concrete and wooden bed have showed better performance than plastic or earthen simple pot with reference to morphological and yield contributing characters and fruit yield of tomato. Application of cow dung (10% w/w) and vermin compost (10% w/w) has increased fruit yield by improving morphological and yield contributing characters of tomato than sole application of cow dung or vermin compost or control conditions.The wooden or concrete bed along with the application of cow dung (10% w/w) and vermin compost (10% w/w) has produced the highest fruit yield of tomato.

37. Sub-project Title: Innovation of flashflood coping rice technology for haor area through participatory approach (ID- 633)

The sub-project is being implemented by the Sylhet Agricultural University SAU), Sylhet at the haor areas for the period from July 2017 to September 2018 with the objectives of i) To assess the occurrence time, frequency and duration of flash flood, ii) To identify flash flood coping promising rice technologies according to site specificity and iii) To select and validate the most promising flash flood coping early rice variety. BINAdhan-14 has been found more prospective variety in regards to yield (6.0t/ha) and duration (130days). Transplantation within first week of January has resulted early harvesting (April) which can easily avoid usual flash flood damage of Boro rice. Farmers have showed their interest about the evolved technology. Longer duration variety BRRIdhan 81 has been also found as promising one due to its tremendous tillering capacity (28 tiller/hill) and yield (7.8 t/ha).

38. Sub-project title: Enhancing the crop productivity through adoption of climate smart technologies in the salinity area of Bangladesh (ID- 656)

The sub-project is being implemented by the Bangladesh Agricultural University (BAU), Mymensingh at Noakhali for the period from July 2017 to September 2018 with the objectives of i) To identify the existing cropping systems being practiced by the farmers in the coastal area of Noakhali district and the reasons liable to poor yields and ii) To increase the yield of *Boro* and Transplant *Aman* rice, sesame, sunflower and maize through varietal selection and adopting salinity stress ameliorative agronomic practices.Major existing cropping pattern has been identified in the study area as Fallow – T. *aman* rice – chilli / bean/ groundnut/ *boro* rice.Irrespective of variety, application of gypsum fertilizer has improved the yield of transplant *aman* rice nearly 10% in both the research locations.Effect of gypsum fertilizer has been found more pronounced in *rabi* crops like maize and sunflower. In combination with mulching, gypsum fertilizer has improved maize and sunflower yields more than 30% as compared to no gypsum fertilizer application.Furrow transplanting in *Boro* rice along with gypsum fertilizer application has been appeared as a very promising technology for increasing the grain yield more than 1.5 t ha^1.

39. Sub-project title: Development of protective cultivation techniques of gladiolus and gerbera in Bangladesh (ID- 668)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been conducting the sub-project at the experimental field of floriculture, HRC, Gazipur for the period from May 2017 to September 2018 with the objectives of i) To develop suitable protective culture technique for gladiolus and gerbera, ii) To standardize optimum substrate for soilless culture of gerbera and iii) To establish technology for off-season gladiolus production. The variety BARI Gladiolus-4 has performed better with regard to attractive flower color, vegetative growth, flower and corm characteristics, yield and quality. Corm treated with GA_3 @ 200 ppm has been produced the best result in respect of plant growth, flowering

Partial view of protective cultivation technique of gerbera at BARI

and yield characteristics of gladiolus in off-season under poly tunnel condition. The promising line GJ-023 has performed better with regard to vegetative growth, flower characteristics, yield and quality under poly house condition. GA_3 @ 100 ppm has accelerated vegetative, flowering, yield and quality characteristics of gerbera. Gerbera varieties have been successfully grown through hydroponic culture. Perlite + coco-dust (1:1 ratio) has been observed the suitable potting substrate followed by coco-dust (100%) for gerbera cultivation in pot.

40. Sub-project title: Identification of major insect and mite pests of major vegetables in Bangladesh and their eco-friendly management (ID- 670)

The sub-project is being implemented by the Sher-e-Bangla Agricultural University, Dhaka at the Dhaka, Narshingdi, Comilla, Rajshahi and Jessore for the duration of April 2017 to September 2018 with the objectives of i) Identification of major insect pests of vegetables from the major vegetable

growing areas of Bangladesh, ii) Identification of major mite pests of vegetables from the major vegetable growing areas of Bangladesh, and iii) Development of eco-friendly management approaches of some important major insect and mite pests of vegetables. Eight insect species of vegetables have been collected and identified. Eco-friendly management of tomato fruit borer, okra shoot and fruit borer, cucurbit (bitter gourd, sweet gourd) fruit fly by using marigold intercropping, black seed oil, neem seed oil, garlic oil, detergent with savlon, netting at seedling stage and seed treatment have been developed.

41. Sub-project title: Productivity enhancement through adaptation of improved crop production technologies in previous enclaves of northern region of Bangladesh (ID- 672)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been conducting the sub-project at Kurigram, Lalmonirhat and Panchagarh for the period from April 2017 to September 2018 with the objectives of i) To find out the alternative crops and cropping patterns by assessing and comparing the existing cropping systems with NARIs technologies, ii) To improve crop productivity through adaptation of selected NARIs developed location specific technologies (crops, cropping patterns and fertilization methods) and iii) To increase efficiency and income of previous enclave farmers. Farmers of the previous enclaves have been found mostly engaged only in subsistence farming with low agricultural productivity. The soils of previous enclaves have been observed as slightly acidic to strongly acidic, low to medium in organic matter content, very high content of P except Dasiarchhara and low to very low content of other nutrients. BARI Sarisha-14 has been found more suitable and profitable across the locations. BARI Alu-46 has been found high yielder but BARI Alu-53 (red skin) has been found more profitable and preferable across the locations. Alternative cropping pattern, Mustard (BARI Sarisha-14)-Boro (BRRI dhan58)-T. aman (BRRI dhan49) with STB based IPNS have resulted 109, 103 & 95% higher REY and 164, 153 & 133% higher GM than existing pattern Fallow-Boro (BRRI dhan28)-T.aman (Swarna) with FP at Dasiarchhara, Dahalakhagrabari and Banskata, respectively. Improved cropping pattern, Potato (BARI Alu-46)-Jute (O-795)-T.aman (Binadhan-17) with STB based IPNS has produced 74% higher REY and 134% higher GM than existing pattern Potato (Lal Pakri)-Jute (Maharastro) -T. aman (Swarna) with FP at Dasiarchhara. Alternative cropping pattern, Potato (BARI Alu-46)-Maize (BHM-9)-T.aman (BRRI dhan49) with STB based IPNS has produced 72 & 70% higher REY and 74 & 72% higher GM than existing pattern Potato (Lal Pakri)-Boro (BRRI dhan28)-T.aman (Swarna) with FP at Dahalakhagrabari and Banskata respectively.

42. Sub-project title: Quantitative analysis for the toxic chemical residues in fruits and vegetables using chromatographic techniques of selected markets in Bangladesh (ID- 695)

The sub-project is being implemented by the Bangladesh Agricultural University (BAU), Mymensingh at the farmers vegetable fields and fruit orchards of Mymensingh, Kishoregonj, Dinajpur, Rangpur, Rajshahi, Bogra, Jessore, Comilla for the period from May 2017 to September 2018 with the objectives of i) Develop protocol for toxicant residues analysis in fruits and vegetables, ii) Assess the amount and degradation rate of leftover residue of commonly used chemicals in fruits and vegetables and iii) Compare the residual level of toxicants among the studied samples in relation to the regions. About 76% pesticides have been found at standard level based on purity test among the available pesticides in selected markets. A total of 6 pesticide residues have been detected in brinjal samples while 3 have been detected in bean and cauliflower samples and the quantities have been found more than MRL Cypermethrin and chlorpyrifos have been found as the common residues in brinjal, bean and cauliflower. The Pre Harvest Interval (PHI) of spraying cypermethrin and chlorpyrifos in brinjal and bean has been found 15 and 30 days respectively. Multiple pesticide residues have also been detected in few vegetable and fruit samples.

43. Sub-project title: Identification of climatic factors responsible for disease and insect outbreak and their appropriate management in southern region of Barisal (ID- 698)

The sub-project is being implemented by the Bangladesh Rice Research Institute (BRRI), Gazipur at Barisal for the duration of April 2017 to September 2018 with the objectives of i) To identify the physical and climatic factors responsible for disease and insect outbreak, ii) To develop effective and sustainable management packages for controlling those pests and iii) To identify breeding location of insects in particular. Temperature at 28-30^{0}C, humidity at 80-90% and rainfall along with rice variety BRRI dhan52 has increased Gall midge infestation; closer spacing, shade, higher humidity and lower temperature have been observed conducive for leaf folder multiplication. Bacterial leaf blight has been observed the major disease followed by brown spot, blast and sheath blight. These diseases have been found higher in local varieties compared to HYV rice. Optimum time of transplanting and dose of urea has been found to decrease the False Smut incidence. Perching, sweeping, light trapping, optimum use of urea and spraying of appropriate insecticide has been reduced the infestation of insects. Gall midge and leaf miner have been found higher in Dasmina, Patuakhali and Shankar Pasha, Pirojpur.

44. Sub-project title: Characterization of important rice germplasm of Bangladesh (ID-701)

The sub-project is being implemented by the Bangladesh Rice Research Institute (BRRI), Gazipur at its HQ for the period from April 2017 to September 2018 with the objectives of i) To characterize rice germplasm both morphological and at molecular level and ii) To study the genetic diversity of Bangladeshi rice germplasm. Morphological and molecular characterization of 96 germplasm (48 T. Aman and 48 Boro rice) have been completed. Among the T. Aman rice, 05 accessions have been observed short growth duration (<120 days), 09 germplasm have been found having long slender grain and 02 germplasm (Chapail and Laitasail) has high TGW (>30 g). The highest grain length breadth ratio (4.56) has been observed in Beruin (acc. 7357) and has been considered as long slender type. Among the Boro germplasm, 01 accession number 3447(Gobirsail) has short growth duration (<135 days), 01 accession number 1648 (Elachi Boro) has higher filled grains per panicle (250) and 01 landrace namely Jagi (Acc. 545) has been found the highest yielder. In T. Aman season, 48 germplasm have been characterized with 90 primers of which 69 have been polymorphic. Similarly, 48 Boro germplasm using 90 primers has revealed 65 as polymorphic. A total of 41 and 14 unique alleles have been found in T. aman and Boro rice germplasm respectively for specific landrace identification, for instance, the popular rice germplasm “Rajasail” has been uniquely identified using RM16, “Jotagainja” with RM455 and “Jagli” with RM447. 48 T. aman and 48 Boro rice germplasm have been grouped into two & three clusters using structure analysis. From the molecular characterization, it has been observed that RM206 (0.87) has been supposed to be the best marker for characterizing the 48 T.aman rice germplasm for higher PIC value and also RM302 for Boro rice germplasm.

45. Sub-project title: Combating seedling blight and raising healthy seedling of rice in cold environment (ID- 708)

Bangladesh Rice Research Institute (BRRI), Gazipur has been implementing the sub-project at Gazipur,Rajshahi and Rangpur for the duration of June 2017 to September 2018 with the objectives of i) Development of control measures for seedling blight disease and effective seedling raising method during Boro season, ii) Digitalization of *Ankuri* seed germinator and efficacy of *Ankuri* seed germination technique at farmers’ level and iii) Skill development and knowledge empowerment of farmers on healthy seedling

Healthy seedling production of rice at BRRI

raising technique in trays and field. Two causal pathogens (Fusarium semitectum and Curvularia) have been detected morphologically. Five effective fungicides have been identified to control the seedling blight disease. Cultural management system has been suggested for the control of seedling blight and good seedling growth. Nutrient management system has been developed for good growth of seedling.Standardization of nutrient spray of NPKSZn has been confirmed. Auto controlled seed germination device (Ankuri) has been developed.

46. Sub-project title: Identify and formulate bio-pesticides to control bakanae pathogen (ID- 712)

The sub-project is being implemented by the Bangladesh Rice Research Institute (BRRI), Gazipur at its Plant Pathology Laboratory and field for the duration of April 2017 to September 2018 with the objectives of i) To find out effective microbes (*Bacillus* spp, *Pseudomonas* spp., *Trichoderma* spp.) along with plant active ingredients/plant products as sources of biopesticide/s for controlling bakanae disease, ii) To find out suitable carrier material with prolong shelf life for biopesticide formulation and iii) Strengthening research facility of Plant Pathology Laboratory. Forty (40) bio-controlling bacterial isolates have been isolated using morphological identification and preserved for further work .Duel culture technique has been used in Lab. condition for determining inhibition zone between bio-controlling agent and virulent isolate causing bakanae disease. Six (6) Trichoderma spp. have been isolated and preserved for further work. Duel culture technique has been used in Lab. condition for determining inhibition zone between bio-controlling agent and virulent isolate causing bakanae disease. Three plant products (neem leaves, Dodder plant and Mehogoni seed extraction in ethanol) have also found promising to control the pathogen in vitro.

47. Sub-project title: Introgression of heat tolerant QTL (qHTSF4.1) into Bangladeshi mega rice varieties through marker-assisted breeding (ID- 714)

The sub-project is being implemented by the Bangladesh Rice Research Institute (BRRI), Gazipur at its HQ for the period from April 2017 to September 2018 with the objectives of i) To introgress heat tolerant QTL (*qHTSF4.1*) in to Bangladeshi mega rice varieties, ii) To evaluate phenotypic gain of heat tolerant QTL introgression lines against high temperature in controlled condition and iii) To promote fixed introgression lines for yield and other traits for recommending in to proposed variety trial. Hybridization for introgression of *qHTSF4.1* QTL into BRRI dhan48 and BRRI dhan58 have been done successfully and 75 F_1 seed has produced. Genotyping of F_1's has been completed through marker and 28 F_1 has been confirmed. First backcrossing has been carried out in the confirmed progenies of BRRI dhan48 and BRRI dhan58 successfully and 1534 BC_1F_1 seeds have been produced. 88 lines having fixed QTL loci (*qHTSF4.1*) of BRRI dhan28 and BRRI dhan29 have been selected phenotypically and advanced to BC_2F_6 andQTL have been reconfirmed by marker.

48. Sub-project title: Up-scaling of BRRI released new promising rice varieties through quality seed production at farmers' level (ID- 716)

The sub-project is being implemented by the Bangladesh Rice Research Institute (BRRI), Gazipur at Comilla, Mymensingh, Barisal, Jalokathi, Kishoregonj and Netrakona for the duration of July 2017 to September 2018 with the objectives of i) To enhance rapid dissemination of BRRI released new promising T. Aman and Boro rice varieties to the farmers of the specific suitable areas, ii) To strengthen quality seed production from demonstration plots through improved management and facilitate storage and distribution of the seeds among farmers and iii) To train farmers for updating their knowledge and skill on modern rice production. During T. Aman 2017 a total of 31.5 tons paddy grains of BRRI dhan70, 71, 75, 76 and 77 have been produced through block demonstrations in 4 districts from which a total of 15.5 tons have been retained as seeds by the farmers. A total of about 1300 farmers have

gained awareness and knowledge about the new varieties of aman and out of them 80% farmers have preferred BRRI dhan 71, 75 and 76. During Boro 2018 a total of 42.3 tons paddy grains of BRRI dhan58, 60 and 63 have been produced in Mymensing, Comilla, Netrakona and Kishoreganj from which a total of 127.20 tons have been retained as seeds by the farmers. A total of about 1285 farmers have gained awareness and knowledge about the new varieties of Boro and out of them 55% farmers have preferred BRRI dhan 58 and 60. A total of 40 plastic drums (each capacity of about 75-80 kg paddy) have been distributed among the innovative farmers of the demonstration areas for storing seeds. A total of 90 farmers have been trained in 3 batches in 2 upazillas of Mymensingh and 1 upazilla of Netrakona districts.

49. Sub-project title: Integrated rodent management in wheat and rice through ecofriendly control techniques (ID- 729)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been executing the sub-project at Rajshahi and Dinajpur for the period from April 2017 to September 2018 with the objectives of i) To study on rodent species composition and their damage severity in wheat and T-aman rice, ii) To develop appropriate techniques for controlling rodents in wheat & T-aman rice and iii) To validate and upscaling of developed rodent control techniques. Highest numbers of burrows have been recorded at grain filling stage (14.25/ha) and ripening stage (16.75/ha) of rice. In wheat field, similar numbers of burrow opening have been observed in grain filling to ripening stage. The wheat field of Dinajpur has been highly affected than the field of Rajshahi. About 13% rat damage has been observed in wheat whereas about 7% in rice field. Trapping followed by acute and chronic poison has showed the best result (up to 93.33 % success) for controlling rodent in rice field. Trapping followed by acute poison only has showed up to 78% success for rodent control. About 35% success has been found in case of using live trap whereas kill trap has showed only 24% success. About 70% captured animals have been found *Bandicota bengalensis*. Similarly in wheat field, trapping followed by acute and chronic poison has showed the highest success (up to 96.67 % reduction over control) for controlling rodent. Trapping followed by acute poison only has showed up to 82.06% success for rodent control. About 50% success has been found in case of using only live trap and kill trap. Majority (85.83%) of captured animal have been found *Bandicota bengalensis* whereas a few numbers (14.17%) of *Rattua rattus have also been* trapped.

50. Sub-project title: Development of propagation and processing technology for bay leaf and cinnamon (ID- 730)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been conducting the sub-project at Gazipur and Jaintiapur for the duration of May 2017 to September 2018 with the objectives of i) To develop standard propagation techniques for rapid dissemination of bay leaf and cinnamon to ensure quality sapling production, ii) To develop processing techniques for bay leaf and cinnamon for quality leaf and quill production and iii) To enhance quality sapling production to increase cultivation expansion and domestic production of cinnamon and bay leaf. Air layering of Cinnamon (31%) and Bay leaf (48%) in April-May with 3000-4000ppm IBA has been found better for successful rooting and establishment. Cinnamon took longer time than Bay leaf. Cutting of Bay leaf and Cinnamon is not suitable as no rooting has been observed in any month or any level of IBA or NAA treatment. Cleft grafting has showed 56.3% success in Cinnamon but only 6.7% in Bay leaf in March grafting. Success on Contact grafting has been found better in Bay leaf (73%) and cinnamon (88%). Drying of Cinnamon at 40ºC temperature in the oven without pre-treatment has been found better. Fresh Bay leaf dried at 40ºC temperature or sun drying without pretreatment has been found better.

51. Sub-project title: Validation of integrated pest management (IPM) technologies in the farmers fields against major insect pests of soybean at Noakhali region (ID- 732)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at Noakhali and Laximpur for the period from April 2017 to September 2018 with the objectives of i) To validate IPM technologies in the farmers fields for creating awareness, ii) To popularize IPM technologies among the farmers and iii) To increase the yield of soybean by applying IPM technologies in the fields. Thirty species of insect pests have been identified to infest soybean in Noakhali regions. Of these, only 6 species namely, hairy caterpillar, leaf roller, common cutworm, pod borer, stem fly & white fly have been considered as the major pests for extent of crop damage. Most of the major insects have been appeared and infested in the crop (about 100%) during vegetative to reproductive stages (30-50 DAS) of the crop causing about 30% yield loss in 2018. The most effective IPM technolog has been found Hand picking + Perching + Sex pheromone trap +Bio-control agent reduced the highest insect population and their infestation (80-90%) and has produced the highest seed yield (2.25 t/ha) compared to farmers practice and has reduced production cost (30%).

52. Sub-project title: Production and field release of parasitoids and predators for management of major insect pest of sugar crop (ID -744)

Bangladesh Sugar Crop Research Institute (BSRI), Pabna has been conducting the sub-project at the BSRI Entomology Lab., BSRI Farm and farmers fields of Pabna and Natore for the period from April 2017 to September 2018 with the objectives of i) Development of mass rearing protocol for predators, *Forficula auricularia*, egg parasitoids, *Trichogramma chilonis* and larval parasitoids, *Bracon hebetor*, ii) Developmentof a suitable field release techniques for the management of major insect pests of sugarcane and sugarbeet and iii) Demonstration and adoption of appropriate pest management practices with bio-agents to the farmers field. To control Sugar beet caterpillar, 50.37% larval population has been decreased over control at Pabna location and 55.64% larval population has been decreased over control at Natore location. To control sugarcane stem borer by releasing Earwig, 46.79% and 42.72% infestation have been decreased over control at Pabna and Natore location respectively. For controlling Top shoot borer, 38.85% and 34.58% infestation has been decreased over control at Pabna and Natore location respectively. For controlling Rootstock borer, 32.99%% and 41.27% infestation has been decreased over control at Pabna and Natore location respectively. In Trichogramma chilonis release technique strip method has been performed better (55.91%). 1101ml egg of *Corcyra cephalonica* has been collected during June'17-May'18. Total number of *Corcyra* adult has been observed 1,48,372 during this time. 54 trip has been prepared for parasitization of *Trichogramma*.

53. Sub-project title: Induction of somaclonal variation in non-flowering germplasm of sugarcane through in vitro culture (ID- 753)

The sub-project is being implemented by the Bangladesh Sugar Crop Research Institute (BSRI), Pabna at the Tissue Cultue Lab. and research field of BSRI, Ishurdi, Pabna for the duration of April 2017 September 2018 with the objectives of i) Induction of somaclonal variants, ii) Detection of somaclones and iii) Enrichment of sugarcane germplasm bank. From the germplasm bank of BSRI, non-flowering 20 sugarcane germplasm have been selected for development of somatic variants. Callus has been developed from the selected germplasm through in vitro cultre. A total of 1677 number of somatic variants have been developed *in vitro* and acclimatized to soil at natural environment under transparent covered condition. After hardening of *in vitro* plantlets, field experiment has been set up at BSRI farm following augmented design. Survivability of variants in the field and number of tiller per plant has been recorded after 30 and 140 days of plantation. Out of 1677 variants, 1223 have been survived in field and the highest 4.64 number of tiller pet plant has been recorded by the variant of Isd 34 followed by Isd 37 (4.33) and CP 48-103 (3.62).

54. Sub-project title: Enhancement of productivity of kenaf in char areas (ID- 755)

Bangladesh Jute Research Institute (BJRI), Dhaka has been implementing the sub-project at Kurigram and Gaibandha for the period from April 2017-Sep 2018 with the objectives of i) To identify key sustainability and environmental impact issues due to kenaf cultivation under suitable cropping pattern in char areas and ii) To develop kenaf seed production technique for mitigating seed crisis. Yield performance of BJRI and local varieties of Kenaf, the average highest fibre yield (3.90 tons ha^{-1}) has been found in BJRI Kenaf 3 at Ulipur and Sundarganj sites. Developed cropping pattern Potato-Kenaf-T.Aman has been found suitable over existing cropping pattern Potato-Jute-T.Aman in Char areas. Gross return and gross margin have been found higher in improved cropping pattern over existing cropping pattern. In late season, the average highest seed yield (1036.17 $kgha^{-1}$) of Kenaf has been recorded in BJRI Kenaf 3 at both the locations.The highest kenaf seed has been obtained from mechanical method of threshing in all the drying period and minimum requirement of time. Seed threshing through mechanical method has been found more profitable than traditional method.

55. Sub-project title: Selection of super high-yielding rice genotypes (ID- 765)

Bangladesh Rice Research Institute (BRRI), Gazipur has been conducting the sub-project at Gazipur and Habigonj for the duration of May 2017 to September 2018 with the objectives of i) To select super high yielding lines for favorable boro areas having improved morpho-physiological traits, 300-350 filled grains/panicle and 9 t/ha yield compared with BRRI dhan 28 and 29 and to produce quality seeds of selected genotypes, ii) To identify promising morpho-physiological traits of super rice lines – responsible for higher yield under recommended crop-management practices and iii) To select super high yielding boro genotypes (yield target 9 t/ha) involving farmers in participatory varietal selection procedures and to promote activities for releasing as variety. Genotypes BR10238-5-1, BR9292-6-2-1B and BR9396-2-6-2B with higher yield and shorter growth duration have been selected. Promising morpho-physiological traits (thick, erect and long flag leaves, deep green leaves and stems, strong stems, vigorous root systems) correlated with higher yield have been identified in BRH11-9-11-4-5B and BR10230-15-27-7B. Improved anatomical features in stem of BR10230-27-19-5-7 has been found for larger vascular bundle size, large longitudinal veins, radically arranged mesophyll cells compared with C_3 rice. BR10230-15-27-7B (score 2), BR10238-5-1(score 2) and BR7566-4-4-2 (score 2) have been selected as deep rooted genotypes for further evaluation. Genotypes BRH11-9-11-4-5B, BR10238-5-1 and BR9292-6-2-1B with higher yield have been selected as super high yielding rice for boro season.

View of field experiment at BRRI

56. Sub-project title: Screening of shattering tolerance of Brassica napus (ID- 767)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been conducting the sub-project at its RARS Jamalpur for the period from May 2017 to September 2018 with the objectives of i) Development of shattering tolerance *B. napus* lines, ii) Increase the yield of *B. napus* and iii) Reduce the shattering loss in *B. napus*. BEN-21 and BEN-19 are two *Brassica napus lines* which have been found tolerance to shattering but their yield potentiality is poor. Compensating yield and shattering tolerance; NAP-15020, NAP-16041 and NAP-0733-1 have been selected. They have been found moderately shattering tolerance as well as produced good yield.

57. Sub-project title: Utilization of fallow land using underutilized crops in coastal saline area of Noakhali (ID- 768)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been executing the sub-project at Subarnachar under Companigonj and Hattiya upazilla of Noakhali for the period from April 2017 to September 2018 with the objectives of i) To increase crop diversification and cropping intensity by introducing and cultivation of newly developed high yielding varieties of underutilized crops (Barley, Foxtail millets, Proso millet, Sorghum, Safflower and Linseed) as well as collection and evaluation of local planting materials available in other areas, ii) To concentrate on developing a suitable management system for untested saline fallow lands in coastal char area which not yet go through this practice and iii) To develop suitable post-harvest machineries for using household level and prepare different kinds of food products, assess their quality and make it familiar with consumer level through active participation of farmers. Among six (06) underutilized crops, four (04) crops namely – Proso millet, Safflower, Sorghum and Linseed have been found more suitable for cultivation in moderate to strong (6.1 to 12 dSm^{-1}) saline areas. Barley has been found suitable for moderate (6.1to 8 dSm^{-1}) saline areas whereas Foxtail millet has been found suitable for slightly (4 to 6 dSm^{-1}) saline areas. Out of 28 intercropping systems, more than 10 systems have been found promising for coastal area for further up-scaling. Three prototypes for post-harvest practices of underutilized crops have been developed and testing has been continuing in farmers conditions.

58. Sub-project title: Improvement of dry direct seeded boro rice based cropping pattern through climate smart technologies and its adoption in drought-prone areas (ID- 777)

The sub-project is being carried out by the Bangladesh Agricultural University (BAU), Mymensingh at Rajshahi and Dinajpur for the duration of April 2017 to September 2018 with the objectives of i) To select suitable T. Aman – Rabi – DDS Boro cropping pattern(s) through farmer's participatory approach, ii) To evaluate the effect of different climate smart technologies on the agronomic efficiency and productivity of T. Aman – Mustard – DDS Boro pattern and iii) To improve awareness of the farmers to the DDS boro rice based cropping patterns towards adoption of the technology package.Dry direct seeded boro rice has been produced successfully after different rabi crops such as mustard, potato, field pea, french bean, tomato, lentil etc. Organic amendment by tricho-compost, vermicompost or mustard oil cake does not have any significant effect on yield performance of dry direct seeded boro rice over the recommended rates of fertilizers. Boro rice cultivation with dry direct seeding technology has saved over 50% irrigation water compared to puddle transplanted one. Dry direct seeding by VMP has saved more than 75% labour costs for planting compared to manual transplanting. Dry direct seeded boro rice based cropping pattern has increased cropping intensity and farm productivity.

59. Sub-project title: Collection, conservation and maintenance of different fruits germplasm in the hilly region of Bangladesh (ID- 783)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been implementing the sub-project at Khagrachari for the period from April 2017 to September 2018 with the objectives of i) Collection of Indigenous germplasm of diversified fruit species from different locations of Khagrachari, ii) Conservation of collected germplasm through ex-situ methods of conservation and iii) Maintenance of germplasm for further research works and varietal development activities. Thirty two indigenous germplasm of 12 fruits have been collected from different location of CHT. Nine mango (6 late and 3 early),1 jackfruit (year round), 3 burmese grape (regular bearer),2 guava (attractive colour & taste), 3 sweet orange (Juicy, sweet, large fruit size), 1 kaffir lime (Juicy, sweet), 2 mandarin (Juicy, sweet, large fruit size), 1 pomegranate (Large fruit size & taste),1 sweet lime (Small, thin & sweet skin), 1 olive (Large fruit size & taste), 1 bel (Large fruit size & bitter less) and 1Indian plum (medium fruit size & profuse bearing) germplasm have been collected. Eight indigenous germplasm of 6 fruits have been identified from different locations of Khagrachari which will be collected in the next season.

60. Sub-project title: Study on bionomics, species diversity/host range, management technique of mealy bug in kenaf and mesta (ID- 785)

Bangladesh Jute Research Institute (BJRI), Dhaka has been conducting the sub-project at Dhaka, Manikgonj, Rangpur, Patuakhali and Kishoregonj for the period from April 2017 to September 2018 with the objectives of i) To study the biology, and host diversity of mealy bug ii) To quantify the yield loss caused due to mealybug infestation and iii) To develop a suitable management package against mealybug. The highest infestation of mealy bug (80.49%) has been found in BJRI Kenaf variety (HC-95) at Narayanganj Sub Station of BJRI and the most infested part of plant has been observed the twig. Mealy bug infestation has also been found in jute plant especially in O-9897 and 0-795 variety in Faridpur and Comilla Regional Station of BJRI.Among the kenaf and mesta varieties, BJRI Kenaf-3 (Bot kenaf) has been observed the most susceptible to mealy bug where the highest level of mealy bug infestation has been found 73.59% causing 34.36% fibre yield loss at Rangpur Station.The life cycle of mealy bug has been observed 35-37 days. Duration of first, second & third instars and adult have been observed 3-4, 6-9, 7-9 and 14-18 days respectively.Phytoclean (Bio-pesticide) and Sevin 85 SP have been found the most effective for controlling mealy bug.

61. Sub-project title: Improvement of spices varieties cumin, sweet pepper, chilli, turmeric and black pepper through induced mutation (ID- 804)

Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh has been implementing the sub-project at Mymensingh, Khagrachari, Magura, Comilla and Rangpur for the period from April 2017 to September 2018 with the objectives of i) Collection of local and exotic germplasm of cumin, sweet pepper, chilli, turmeric and black pepper, ii) Screening of the collected germplasm of these spices and irradiation of the seeds for generating mutants and iii) Selection and evaluation of desirable mutants for developing varieties with high yield potential, good aroma and flavour. Thirty three germplasm of spices have been collected. LD50 / GR50 have been estimated for Chilli: 75 –100Gy, Capsicum: 75-105 Gy, Turmeric: 2-3 Gy, Cumin: 3-5 Gy. M_1 populations of chilli, capsicum and turmeric have been harvested. M_2 screening of turmeric has been conducted at Mymensingh, Magura and Khagrachori. Multi-location trials of promising mutants of chilli and turmeric would be conducted and evaluated for registration of variety.

62. Sub-project title: Development of salinity tolerant wheat variety through physiological and bio-chemical apprasisal (ID- 809)

The sub-project is being conducted by the Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur at the experimental field of Agronomy for the duration of April 2017 to September 2018 with the objectives of i) To screen wheat genotypes against salinity tolerance, ii) To analyze morphological, physiological and biochemical changes of selected wheat genotypes against salinity tolerance and iii) To develop wheat variety tolerant to salinity. After screening, five promising wheat genotypes have been selected against salinity. The best physiological, biochemical and yield data have been found in genotype BU-2008-4, which has indicated the tolerance against salinity (Yield reduction of 4.5%, 9.42% and 12.30% at 5, 10 & 15 ds/m salinity level respectively).

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

63. Sub-project title: Socio-economic impact on wheat research and development in Bangladesh (ID- 378)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at Dinajpur, Rajshahi, Faridpur, Jamalpur, Tangail, Kushtia and Madaripur for the period from April 2017 to September 2018 with the objectives of 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 and iii) To estimate the returns to investment (IRR, NPV, BCR) in wheat research and development in Bangladesh. BARI Gom-24 has covered 32.15% of wheat area followed by BARI Gom-26 (22.35%) and BARI Gom-25 (20.61%).Growth rate of area and production of wheat have been increased significantly at the rate of 2.50% and 3.00% respectively during the period of 1986-87 to 2015-16.Area, production and yield instabilities of wheat have been found 20.76, 26.91 and 13.65 respectively in terms of instability index during the period of 1986-87 to 2015-16. The extent of fluctuations of area, production and yield have been ranged between -16.58 to 16.36, -24.64 to 28.05 and -12.14 to 20.07 percent respectively during the period of 1999-2000 to 2015-16. Production has been fluctuated more than areas and yield of wheat.

64. Sub-project title: Cultivation, marketing and processing of medicinal and aromatic plants (MAPs) in Bangladesh (ID-393)

Bangladesh Agricultural University (BAU), Mymensingh has been implementing the sub-project at Natore,Moulvibazar and Bogura for the duration of June 2017 to September 2018 with the objectives of i) To understand the existing production systems, cost and return, and key social, institutional, environmental and other factors that govern the present status of MAPs, ii) To map the value chain and estimate the value addition in each of the nodes in the value chain and assess the efficiency of the value chains and iii) To identify the constraints in production, marketing and processing of MAPs. Nail setting and purchase costs are the major cost item to agar producer and processor respectively. Agar product has been observed moves from producer to the ultimate consumer using four major types of supply chain. Appropriate pesticides and methods & machineries have not known to agar plant producers for spraying pesticides for controlling insects and diseases.Due to poverty and urgent cash need, the producers have been compelled to sell immature agar plants to the processors in advance at cheaper price (net return per tree BDT 2,103.27). Producers have been seriously harassed in collecting No Objection Certificate (NOC) and Transport Permit (TP) for harvesting and transporting of plants.

65. Sub-project title: Assessment of postharvest losses based on postharvest practices and marketing performances in selected vegetable supply chains in Bangladesh (ID-406)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at Jamalpur, Jessore, Rangpur and Kushtia for the period from April 2017 to September 2018 with the objectives of i)To assess the knowledge, attitude and practices (KAP) of different stakeholders toward post-harvest handling, losses as well as food safety and food quality in selected vegetable supply chains, ii) To estimate postharvest losses at different segments of selected vegetable supply chains and to identify factors affecting postharvest losses at farm and trader's level and iii) To assess the status of market opportunities through analysing supply chains for selected vegetables in the study area. Both pre and post-harvest practices have been found responsible for postharvest losses of vegetables. The main cause of PHL has been observed improper sorting & grading of vegetables after harvest. Farmers have been used bamboo basket (63.4%), plastic crate (17.8%) and jute/ plastic sac (10.9%) for harvesting as well as packaging containers. Insect- pest infestation, virus infection, stem rot disease and lack of labourers have been identified as the major problems of vegetable production. Farmers have been used plenty of pesticides non-judiciously to protect their crops(54 times for brinjal, 13 times for bitter gourd and yardlong bean, and 23 times for teasel gourd per season). Although most farmers (64-90%) have been sold their produce to *Bepari* at the local assemble/primary markets, a good portion (10- 33 %) has also been sold at the crop field. Both mechanized (20%) and non-mechanized (42%) van has been the major mode of transports. The total postharvest loss of vegetables at farm level has been ranged from 5-8% due to odd size, insect-pest infestation, disease infection, over maturity, physical crack and injury, and ripeness of vegetables.

66. Sub-project title: Supply chain analysis of major vegetables produce in hill and coastal regions of Bangladesh (ID- 407)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at Rangamati, Khagrachari, Bandarban, Patuakhali, Satkhira and Cox's Bazar for the period from July 2017 to September 2018 with the objectives of i) To analyze input supply, production system and profitability of major vegetables in hill and coastal region, ii) To examine the existing market, marketing system and supply chain of selected vegetables in those areas, iii) To identify the linkage/integration between local market and different city market of selected vegetables and iv) To identify the production and marketing drawbacks and suggest some policy recommendations for improving the vegetables supply chain. Vegetable production techniques in hilly (Homestead, plain land & jhum cultivation) and coastal regions (Plain land cultivation, sorjon method and composite agriculture -Gher based agriculture) have been identified. Maximum quantities of produced vegetables have been consumed within the district and minimum quantities have been marketed at distance market after fulfilling local demand. Identified major supply chains are: Farmer cum Retailer-Consumer, Farmer-Retailer-Consumer, Farmer- Bepari- Arathdar- Retailer- Cosumer, and Farmer- Arathdar-Paiker cum Retailer –Consumer. Major constraints have been found in the vegetables supply chains are in the area of production (salinity, heavy rain, drought, ignorance about the modern technology, lack of irrigation facilities etc.), marketing (high transportation cost, lack of distance traders, shortage of capital, lack of permanent retail market etc.) and linkage of rural market with urban market (lack of market information & road communication, high transport cost etc.). Vegetables cultivation has been found profitable in hill (Average net return / ha BDT 1.8 lakh), and coastal region (Average net return / ha BDT 1.57 lakh)

67. Sub-project title: Impact of improved aquaculture technologies on productivity and livelihood of fish farmers in Bangladesh (ID- 429)

The sub-project is being carried out by the Sher-e-Bangla Agricultural University (SAU), Dhaka at Bagherhat, Brahmanbaria, Chadpur, Cox's Bazar, Jessore, Khulna, Kishoregonj, Laximpur, Moulvibazar, Mymensingh, Rajshahi and Satkhira for the period from April 2017 to September 2018 with the objectives of i) To compare productivity and profitability of fish farming between traditional and improved fisheries technologies users, ii) To identify the determinants of adopting improved fisheries technologies at farm level and iii) To assess the impact of improved fisheries technology on fish yield and livelihood of fish farmers. Most of the respondents have been adopted improved crab production technologies in the study areas. Education and extension contact has positively influenced the adoption decision.The farmers who have their own pond have adopted more. Duration of trainings and more experienced farmers have been adopting more.Adopters of improved technologies have been received significantly higher yield and profitability compared to the non-adopters.Fish consumption of the adopters has found significantly higher than non-adopters which indicated that standard of living of adopters have better than non-adopters. The adopters have been spent more on purchasing fishing equipment compared to non-adopters. Adoption of improved crab production technologies has been positively enhancing the productivity, profitability and standard of living of the adopters.

68. Sub-project title: Agricultural practices and livelihood patterns of selected tribal communities in Bangladesh (ID- 454)

The sub-project is being conducted by the Sylhet Agricultural University (SAU), Sylhet at Sylhet and Chittagong divisions for the period of July 2017 to September 2018 with the objectives of i) To identify the socioeconomic profile and livelihood pattern of tribal farmers' of Sylhet and Chittagong regions, ii) To know the agricultural practices of tribal farmers' and iii) To explore the potentiality of the use of agricultural technologies to improve the livelihood of tribal farmers. Tribal peoples have been observed lag behind the mainstream of the country in terms of socioeconomic development and livelihood. Tribal farmers have been engaged in agriculture as well as other income generating activities where majority of them produced agricultural commodities. The most common farming practices have been observed- Crop-Livestock-Poultry (C-L-P), Crop- Poultry-Homestead enterprise (C-P-H) and Crop-Livestock-Homestead enterprise (C-L-H), which have also been found more or less profitable. Agricultural technologies like betel leaf, betel nut and ell fish production (Cuchia), agro-forestry plantation, coffee tree cultivation, jhum cultivation, medicinal plant cultivation and rice cultivation (local) have been practiced by the tribal farmers. Constraints like lack of knowledge on modern agricultural technologies, lack of extension service, high price of inputs, etc. have been hindered the agricultural development of the tribal communities. Training, motivation, support and extension services of different government and non-government organizations might raise the awareness about modern agricultural technologies for further increasing the agricultural production as well as improving their livelihood.

69. Sub-project title: Development of a business model on crops and cattle for low carbon farming technique: An initiative for farm level in coastal region of Bangladesh (ID- 593)

Bangladesh Agricultural University (BAU), Mymensingh has been conducting the sub-project at Bagerhat and Satkhira for the period from April 2017 to September 2018 with the objectives of i) To provide direct enterprise assistance to adopt low carbon farming techniques and disseminate community based adaptation practices, ii) To develop business model on crop and cattle combination

in farm for economic and environmentally sustainable low carbon farming by bio-gas production and bio-char utilization and iii) To formulate climate change adoption policy for improving farm level adaptation capacity. The low carbon farming has been able to decrease 25 % production costs and enhances yield, thus improving farm profitability. The farmers have been using BINA dhan-8 and BINA dhan-10 in the saline prone coastal area. The average yield of rice has been found 3.575 MT /hectare. The new crop-cattle mix business model has been provided supplemental farmer income. The extra net benefits of farm having 5 cows have been estimated BDT 66,000 per year other than the rice, milk and net change in animal inventory. The bio-gas and compost sell have been found to ensure this extra income to the farm. Low carbon farming has been able to provide additional short and long-term co-benefits to the environment, including improving saline soil and resilience to climate change.

70. Sub-project title: Economics of adoption of bio-security measures for controlling avian influenza in Bangladesh`s poultry farms (ID- 649)

The sub-project is being implemented by the Bangladesh Agricultural University (BAU), Mymensingh at Gazipur, Narsingdi, Kishoregonj, Tangail, Rangpur, Bogura and Mymensingh for the period from July 2017 to September 2018 with the objectives of i) To examine the level of adoption of bio-security measures by different categories of poultry farms, ii) To estimate the private and social costs and returns from complying bio-security measures by the poultry farms and iii) To examine the driving factors associated with the adoption of bio-security measures by poultry farms. Comparing level of bio-security knowledge and practices for both broiler & layer farms, layer farms (78.26%) have been found more bio-secured than broiler farms (21.74%). Most of the poultry farms have been found not totally bio- secured.

71. Sub-project title: Value chain analysis of rice and its byproducts in Bangladesh (ID- 700)

The sub-project is being implemented by the Bangladesh Rice Research Institute (BRRI), Gazipur at the automatic rice millers and oil mills for the period from April 2017 to September 2018 with the objectives of i) To identify major value chains for rice and rice by-products (rice bran and bran oil, rice husk, feeds) in Bangladesh, ii) To map the different activities of the actors and value addition processes of the respective chains focusing distributional issues as well as costs and margins of the actors involved in the chains and iii) Sketch the feasibilities and future prospects of value chains of rice byproducts as a new dimension for the economy of Bangladesh. The average recovery ratio for head rice, dead rice, broken rice, rice bran and husk have been found 61.00%, 3.51%, 6.49%,8.50% and 20.50% respectively from the automatic rice millers. Total production capacity of ten surveyed oil mills has been found 197000 ton/year where as these mills have been utilized 64% of the capacity which has produced 125500 ton/year of rice bran oil. Production cost of rice bran oil (RBO) has been found BDT 87000 per ton Major supply chains of aromatic rice are found as a)Farmer>Faria>Paddyarathder>Miller>Arathder(rice)>Wholesaler>Retailer>Conumer,b)Farmer>Bepari>Paddyarathder>Miller>Arathder(rice)>Wholesaler>Retailer>Conumer,andc)Farmer>Bepari>Paddyarathder>Miller>Companies(Pran,ACI,Chachi)>Dealer>Retailer>Conumer.Two dominant supply chains of rice bran oil (RBO) have been observed- Miller > Dealer > Retailer> Consumer and Rice Bran Oil Miller > Company (Pran, Pusti, ACI, Aristocrate) > Dealer > Retailer > Consumer. The key problems of RBO have been identified as unavailability of adequate rice bran and lack of promotional activities at consumer level.

72. Sub-project title: Cost and return analysis of sugarcane production with intercrops in Bangladesh (ID- 750)

The sub-project is being conducted by the Bangladesh Sugar Crop Research Institute (BSRI), Pabna at Thakurgaon, Natore, Faridpur, Sirajgonj, Chuadanga, Chapainawabgonj, Bagerhat, Manikgonj, Barisal,

Gazipur, Chandpur and Habigonj for the duration of April 2017-September 2018 with the objectives of i) To determine the level of input use and estimate cost and return of sugarcane production with intercrops, ii) To estimate the level and determinants of farm-level technical efficiency of sugarcane farmers and iii) To identify constraints of sugarcane cultivation at farm level. Per hectare yield of sugarcane has been observed 77.43 t and total cost, total return and BCR of sugarcane production in mill zone area have been found BDT 154895/ha, 228425/ha & 1.51 respectively. Benefit cost ratio (BCR) of sugarcane + potato, sugarcane + lentil, sugarcane + coriander and sugarcane + maize in mill zone have been found 1.74, 1.76, 1.70 and 1.73 respectively. In efficiency model of sugarcane sett, human labour, organic manure, furadan, other pesticides and irrigation costs have the positive and significant impact on sugarcane yield. In efficiency model education, experience, farmers training on sugarcane production and regular field visit by the extension workers have the negative and significant impact on sugarcane yield. Average technical efficiency of sugarcane production in mill zone area has been found 77%.

PLANNING AND EVALUATION

73. Sub-project title: Increasing productivity of cropping system in some coastal areas of Bangladesh (ID- 442)

Patuakhali Science and Technology University, Dumki, Patuakhali has been implementing the sub-project at Dumki and Kalapara of Patuakhali for the period of April 2017 to September 2018 with the objectives of i) To develop sustainable production technology of selected *Rabi* crops for improved cropping system in saline and non-saline tidal ecosystem, ii) To evaluate the agro-economic performance of the designed cropping systems in saline and non-saline tidal ecosystem and iii) To assess farmers' response on the acceptability of designed cropping systems.Strip tillage and mulching have been found better for higher yield, net benefit and BCR of all Rabi crops in both saline and non-saline ecosystems. Sunflower is the best in respect of yield (3.57t/ha), net benefit (BDT 168755/ha) and BCR (1.99). In non-saline ecosystem, the highest net benefit (Tk.229651/ha), REY (21.35) and BCR (1.98) are obtained from T. Aus rice (BRRI dhan55)-T. Aman rice (BRRI dhan77)-Sunflower (Pacific Hysun 33) cropping pattern with strip tillage of sunflower. This pattern also produced highest net benefit (Tk.199950/ha), REY (21.08) and BCR (1.77) under mulching condition of sunflower. In saline ecosystem, the highest net benefit (Tk.191835/ha), REY (17.87) and BCR (1.82) have been obtained from T. Aus rice (BRRI dhan55)-T. Aman rice (BRRI dhan73)–Sunflower (Pacific Hysun33) cropping pattern with strip tillage of sunflower. This pattern has also produced highest net benefit (Tk.181990/ha), REY (19.6) and BCR (1.74) under mulching conditions of Rabi crops. The farmers practice Fallow-T.Aman rice (Moulata)-Mungbean (BARI Mung-6 with conventional tillage and broadcasting sowing) in non-saline ecosystem and Fallow-T. Aman rice (Swarnomusuri)-Fallow in saline ecosystem has produced the lowest net benefit, REY and BCR.

74. Sub-project title: Development of a sustainable agricultural risk management technology in areas affected by flash flood using numerical climate modeling data analysis (ID- 512)

Sylhet Agricultural University (SAU), Sylhet has been implementing the sub-project at Sylhet, Sunamgonj and Moulvibazar for the period from April 2017 to September 2018 with the objectives of i) To assess the risk of meteorological disasters; disease and pest damage using meteorological numerical model projection data along with a suitable crop simulation model and ii) To develop a scenario of different crop production in areas affected by flash flood. Flash Flood trend for Sylhet district has been developed. This trend line has already been fitted for past scenario (2010-2017) in both model synthesis (EdGCM and CCSM) and EdGCM predicted flash flood in the upcoming days

of 2018 (completed) to 2020 (in Process) at the study area. Although, there are variations in data of different models of flash flood, all models have their numerous potentiality on predicting flash flood and in all the cases, the test hypothesis of this research may be served as a key indicator of flash flood in this area. Different information about the negative effects of flash flood on crop production has been collected to develop a scenario of the study area.

75. Sub-project title: Agricultural imaging system for rice and mungbean disease detection and management in agro-field (ID- 554)

Patuakhali Science and Technology University (PSTU), Pathuakhali has been conducting the sub-project at the coastal areas of Bangladesh (Patuakhali) for the duration of June 2017 to September 2018 with the objectives of i) To develop a pathological system for crop disease detections through advanced image processing in agricultural field, ii) To establish the real time monitoring technique to manage the crop disease in the field through wireless sensor networking and iii) To obtain the model for identification of the exact causes of devastation in agro field based on Artificial Neural Network (ANN). A software, AgRMD has been developed for detection and classification of rice and mungbean diseases automatically. A new algorithm has been developed for rice and mungbean disease analysis through image processing with ANN model. Wireless networking system has been developed for real time monitoring of agro-field with obtaining near surface soil characteristics.

76. Sub-project title: Enhancing agricultural research information services through digitization of research outputs (ID- 612)

The sub-project is being implemented by the Bangladesh Agricultural Research Council (BARC), Dhaka at the Agricultural Information Centre (AIC) of BARC for the period from April 2017 to September 2018 with the objectives of i) To improve service by ensuring greater accessibility to the e-content of scholarly publications, ii) To develop digital repository of important documents to serve the researchers, policy-makers and other stakeholders, iii) To promote efficient delivery of information to researcher, policy-makers and other end users through Open Archives Initiative (OAI) and iv) To publish research results online and make available in the web to facilitate research capability. Procurement of Hardware & Software has been made as par procurement plan. Server and Linux based Operating System has been installed and customized for local needs. RFID Staff Work station and Tag reader software have been installed for personalization and circulation and RFID Security System has been introduced for check-in check-out system. Koha (Library and Information Management System) and Dspace (Full-text Depository Management System) have also been installed. Identification of the Information sources for Tagging has been completed for the RFID Security System. 2000 tags have been attached to the selected important documents. Populated 1300 records in to Koha database and more data input is underway. Process of digitization of necessary documents and the materials required for enhancing library house keeping operations e.g. accession, acquisition, circulation (check-in, check-out) have been started. Documents like Annual reports, BARC Newsletters, Proceedings, EC and GB meetings Proceedings, MoU, etc. have been digitized and uploaded in the institutional repository. Kiosk has been installed for making library database available for user (Kiosk help user to find out their expected document without help of library professional). Customization of on-line publishing process of research results (journal) is under process. RFID Security gate and display board have been renovated.

77. Sub-project title: Development and up-gradation of digital contents of National Agricultural Display Center (NADC) at BARC (ID- 629)

The sub-project is being implemented by the Bangladesh Agricultural Research Council (BARC), Dhaka at its NADC for the duration of January 2017 to September 2018 with the objectives of i) To collect detail information of displayed items in NADC including developed agricultural technologies by NARS institutes, ii) To digitalize and/or develop contents through text, image and audio-visual format and iii) To develop a user friendly web application and make the contents available through LAN and Internet. ICT related documents including updated technological information (72 varieties, books, poster, leaflet) have been collected from 12 NARS institutes for physical and digital parts. First version of web based application software has been developed and has been collecting feedback from the focal points of NARS institutes. Up-gradation of switch room , replacement of 4 circuit breaker, LED bulb in two floors & Installation of 6 UPS, maintenance of digital touch screen, Kiosk and 9 split type AC have been completed.

78. Sub-project title: Improved crops productivity of beel areas of Bangladesh (ID- 688)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at the beel areas of Sirajgonj, Natore and Faridpur for the duration of April 2017 to September 2018 with the objectives of i) To identify technology (8-10) for improving crop productivity, ii) To adapt HYV and best crop management practices (10-12) and iii) To improve knowledge (120 farmers) and income (20-30%) of farmers. BARI Sarisha-14 and BARI Sarisha-15 were found suitable before *boro* rice in upper land of Chalan Beel area producing higher seed yield (1600-1667 kg/ha) and BCR (1.59-1.65). Nutrient dose of 140-44-70-30-1.8-1 kg/ha of N-P-K-S-Zn-B (125% RN) + Weeding at 15 DAE was found suitable for higher seed yield (1754 kg/ha) of mustard and higher BCR of 1.69. BARI Gom-30 was found superior in upper land of Chalan Beel area in respect higher yield (5.02 t/ha) and BCR of 1.78. Nutrient dose of 125-45-31-25-2-1 kg/ha of N-P-K-S-Zn-B (125% RN) + Weeding at 20 DAE was found suitable for better yield (5.52 t/ha) and economic return (BCR of 1.81) for wheat at Chalan Beel area. Maize varieties named NK-40, 900 M Gold and Miracle produced higher grain yield (10.02-10.64 t/ha) with higher BCR (1.88-2.00) in Chalan Beel area. Nutrient dose, 325-90-185-60-5-2.5 kg/ha of N-P-K-S-Zn-B (125% RN) + Weeding 20 DAE was found suitable for higher grain yield (12.98 t/ha) and BCR of 2.24 for maize cultivation in Chalan Beel area. BARI Piaj-4 and local variety of onion gave better bulb yield (19.61-20.02 t/ha) and higher economic returns (Gross return of Tk. 830400-862000/ha and BCR of 2.00-2.08) in Monglar beel area. Nutrient dose, 150-75-200-50-5.60-2.5 kg/ha of N-P-K-S-Zn-B (125% RN) + Weeding at 30 DAE produced the highest bulb yield (19.96 t/ha) of onion with higher economic returns (BCR of 2.01) in Monglar beel area. Nutrient dose, 26-11-11-5-0.8-0.8 kg/ha of N-P-K-S-Zn-B + hand weeding at 20 DAE and 50-60 DAE was found suitable for higher yield (1.59-1.61 t/ha) and better economic return (gross return of Tk. 35475-41976/ha and BCR of 1.91-2.11) for B. *aman* in beel areas. Nutrient level like 40-20-10-5-0.8-0.5 kg/ha of N-P-K-S-Zn-B + one hand weeding at 5-7 days after harvest of main rice was found suitable for higher yield (2.10 t/ha) and better economic return (gross return of Tk. 46200 /ha and BCR of 3.82) for ratoon rice in Chalan beel area.

79. Sub-project title: Developing mobile APPS for enhancing rice productivity (ID- 715)

The sub-project is being implemented by the Bangladesh Rice Research Institute (BRRI), Gazipur at BRRI HQ and all Regional Stations for the period from April 2017 to September 2018 with the objectives of i) To strengthen the capacity building of BRRI employee in ICT and e-governance in association of SMART agriculture, ii) To increase agricultural productivity through developing mobile apps and rice database for researcher, extension worker, farmer etc., iii) To improve research and development in agriculture through ICT innovations for sustainable development and iv) To strengthen

the linkage among NARS scientists through ICT. Mobile app has been designed & developed. Database has been prepared & developed. Collected data are being processed for preparing rice database & mobile app. Mobile app hosting for Google play store & database hosting at BCC (Bangladesh Computer Council) server are being processed.

80. Sub-project title: Development of mobile APPS for assessment of nitrogen fertilizer in cereal crops (ID- 769)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been conducting the sub-project at Gazipur, Chittagong and Dinajpur for the period from April 2017 to September 2018 with the objectives of i) To use digital camera image and software for assess leaf nitrogen of rice, wheat and maize at different growth stage, ii) To establish a relationship between morpho-physiology parameters with image parameters of rice, wheat and maize and iii) To develop a mobile phone applications for phenotyping and assessment of nitrogen requirement by image analyses. Three softwares have been developed for digital phenotyping of rice, maize and wheat (RCC_BARI for rice, MCC_BARI for Maize and WCC_BARI for Wheat). Algorithms have been developed for relationship between manual phenotyping and digital phenotyping. Algorithms have been developed for relationship between leaf nitrogen and digital field image. Three mobile Apps have been developed for real time estimation of nitrogen fertilizer requirement for rice, maize and wheat.

81. Sub-project title: Screening of sugarcane clones based on adaptive mechanisms under drought and salinity stress due to climatic change (ID- 746)

The sub-project is being conducted by the Bangladesh Sugar Crop Research Institute (BSRI), Pabna at Pabna, Rajshahi, Takurgaon, Khulna and Satkhira for the period from April 2017 September 2018 with the objectives of i) Selecting sugarcane varieties with superior tolerance to abiotic stress condition. Among 5 clones of sugarcane under ZYT-111, I 85-10 and I 103-10 have been performed better than others in drought stress. Among 6 clones of sugarcane under ZYT-11, I 198-11and I 7-11 have been performed better than others in drought stress. Among 5 clones of sugarcane under ZYT-111, I 1227-09, I 103-09 and I 103-09 have been performed better than others in salinity stress. Among 6 clones of sugarcane under ZYT-11, I 7-11, I 198-11, 230-11 and I 131-10 have been performed better than others in salinity stress.

View of sugarcane clones at BSRI

82. Sub-project title: Offline fertilizer recommendation through mobile APPS (ID- 787)

Soil Resource and Development Institute (SRDI), Dhaka has been conducting the sub-project at the 460 upazillas of Bangladesh for the duration of April 2017 to September 2018 with the objectives of i) To provide location specific instant offline fertilizer recommendation through mobile app directly to the farmers as well as other beneficiaries i.e. agricultural extension worker, entrepreneurs of UDC,

scientists of SRDI and other organization, ii) To reduce misuse of chemical fertilizers as well as increase crop production by using union wise soil test based balanced fertilizer through this mobile app and iii) To develop and disseminate a union wise soil fertility and fertilizer use database that will lead to establish an integrated and effective soil, crop and fertilizer management in Bangladesh in the long run. A mobile app has been developed that can provide agro-information on location wise specific fertilizer dose and application method for almost all crops described in Fertilizer Recommendation Guide-2012. The farmers/users need not have any internet connection to operate this app as it has been devised to work in an offline mode. To prepare this mobile apps accurately, all chemical data (soil test values) of all the upazilla (460 volumes) have been classified and processed on the basis of land type, soil texture, soil group, and other characteristics of a union using soil έ land physiographic map to input to the main database for preparing this mobile apps.

SOIL

83. Sub-project title: Inhibition of arsenic accumulation in rice with phyto-fortification of microelements for nutritional safety (ID- 311)

Patuakhali Science and Technology University (PSTU), Patuakhali has been implementing the sub-project at the Central Laboratory of PSTU for the period from April 2017 to September 2018 with the objectives of i) To examine the potentiality of different micro/trace elements like Fe, Mn, Si, Se etc. for inhibition of arsenic bioaccumulation in rice, ii) To find out the suitable dose of micro/trace elements for practical application in different arsenic contaminated soils to avoid deficiency and/or toxicity and iii) To analyze the bioaccumulation/enrichment of micro/trace elements and arsenic in rice and soil. Si and Fe have increased the yield of Aus, Aman and Boro rice grown in As contaminated soil due to their strong antagonistic behavior with As uptake. Arsenic accumulation pattern has been found in order of root > shoot > grain. Better effect has been found in naturally As contaminated soil (grain As < 0.2mg/kg) than artificially As incubated soil due to addition of different microelements (> 0.2 mg/kg) except for Fe treatment. In most cases, phyto-fortification or bio-accumulation of microelements has been increased significantly at different varieties of rice grain.

84. Sub-project title: Development of ginger production technology under soilless culture using fertigation technique in Bangladesh (ID- 323)

View of ginger production under soilless culture at Bogra

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at its Spices Research Centre and sub-centre of Bogura and Lalmonirhat respectively for the duration of April 2017 to September 2018 with the objectives of i) To study the suitability of ginger cultivation under fertigation system, ii) To determine the effect of soilless substrates (such as coco dust, sawdust and paddy husks) on growth and yield of ginger, iii) To determine the optimum growth substrate for ginger cultivation using fertigation technique and iv) To produce disease free healthy seed rhizome for higher

yield and economic return. The highest rhizome yield (45.2 t/ha) has been obtained from plants grown in coco dust media × BARI Ada-1 using fertigation while the lowest yield (8.5 t/ha) has been found from soil × BARI Ada-3. The highest benefit-cost ratio of 2.40 has been recorded with the coco dust media× BARI Ada-1 while the lowest benefit-cost ratio of 0.47 has been observed in rice barn × BARI Ada-3. The highest rhizome yield (14.34 t/ha) has been obtained from plants grown in SRC practices × BARI Ada-1 using conventional method and the lowest yield (6.66 t/ha) has been recorded from farmers practices x BARI Ada -3. The highest benefit-cost ratio of 1.97 has been recorded with the in SRC practices × BARI Ada-1 while the lowest benefit-cost ratio of 0.72 has been observed in the farmers practices x BARI Ada -3. Ginger can profitably be cultivated in coco dust substrates with BARI Ada-1 using fertigation technique.

85. Sub-project title: Development of existing maize based cropping patterns for sustain soil fertility in south-western region of Bangladesh (ID- 382)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at the different upzillas of Jhenaidah, Chuadanga and Meherpur for the period from April 2017 to September 2018 with the objectives of i) To develop present maize based cropping patterns for sustaining soil fertility, ii) To improve and maintain soil fertility through better nutrient management, iii) To adapt improved maize based cropping systems for increasing farmer's income and iv) To increase productivity and profitability for attaining food and nutrition security. In the existing Maize-Fallow-T.Aus cropping pattern Mungbean/ Blackgram can be grown successfully. Maize- Mungbean-T. Aman /T. Aus cropping pattern has been produced 19-26% higher rice equivalent yield compared to existing Maize- Fallow- T.Aus pattern. Farmer's income has been increased 15-24% by adopting the improved Maize-Mungbean-T.Aman/T.Aus cropping pattern.

A view of maize field at Jashore

86. Sub-project title: Management of acid soils for sustainable crop production in Madhupur Tract and Northern & Eastern Piedmont Plains (ID- 419)

The sub-project is being carried out by the Bangladesh Agricultural University (BAU), Mymensingh at the different upazillas of Mymensingh and Sherpur for the duration of April 2017 to September 2018 with the objectives of i) To determine lime and organic manure requirement to attain suitable pH for field crop production and ii) To evaluate the effect of lime and organic matter amendment on yield and nutrient uptake of major crops and cropping patterns. All crops of three cropping patterns (T. Aman rice - Wheat– Mungbean, T. Aman rice -Maize – Fallow, and T. Aman rice -Mustard – Boro) have shown reductions in grain and straw yields in acid prone areas of Fulbaria and Nalitabari Upazilas. Application of lime (Dolomite@2t/ha) has showed an increase in grain and straw yields of crops in all three cropping patterns. Additionally, organic manure alone or in combination with lime has remarkably increased the yield of all crops. Addition of lime and organic manure to acid soils has been found beneficial for achieving sustainable crop productivity in the areas of Madhupur Tract and Northern & Eastern Piedmont Plains.

87. Sub-project title: Conservation agricultural practices for the improvement of soil health, cropping system productivity and farmers' income (ID -492)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at Gazipur (AEZ-28), Jessore (AEZ-11), Rajbari (AEZ-12) and Ishurdi (AEZ-11) for the period from April 2017 to September 2018 with the objectives of i) To monitor the changes in SOM and soil physico- chemical properties as governed by CA practice, ii) To assess the cropping system productivity under intensive rice- based agriculture and iii) To observe economic benefits of CA over traditional practice. Strip tillage (ST) with residue retention has conserved more available soil moisture in soils in wheat field relative to conventional practices (CT) which has resulted higher grain yield of wheat (3.91 t/ha) in ST compared to CT (3.0 t/ha).This practice has also contributed significantly higher system productivity in terms of REY under wheat-mungbean-T.aman cropping pattern. Under ST practice, 25% higher dose of N has produced higher yield of rabi crop, mustard yield might be due to lower mineralization for conservation tillage. Under jute-onion-T.aman cropping pattern, conservation tillage has produced identical yield with conventional tillage. For jute, 125% STB dose of CF has produced higher yield but for the subsequent crops T. aman and onion, 100% STB applied as IPNS providing 80% CF and 20% CD has resulted higher yield. Conservation tillage in combination with 100% STB applied following IPNS approach (80% CF and 20% organic manure) has resulted higher REY. Positive trend of improvement of soil fertility has been observed under conservation tillage practice.

88. Sub-project title: Nutrient management for a rooftop garden (ID- 499)

The sub-project is being executed by the Bangladesh Agricultural Research Institute (BARI), Gazipur at Joydebpur, Mirpur, Dhanmondi, Bashunhara and Uttara for the duration of April 2017 to September 2018 with the objectives of i) To develop fertilizer recommendation for vegetables, fruits and flowers grown on the rooftop garden, ii) To find out the optimum soil and manure ratio as a media for better growth and development of crops under rooftop garden and iii) To increase yield, popularize rooftop garden in the urban area and ensure family nutrition. In case of soil, organic and inorganic fertilizer combination, application of 80% of STB doses+ 2 kg vermicompost /6kg soil has been found more effective for maximizing the yield of vegetables, fruits and flowers grown on the rooftop garden. In case of soil and organic fertilizer combination, vegetables (capsicum & bottle gourd), fruits (strawberry) and flowers (periwinkle, gladiolus & gerbeara) grown on the rooftop garden have performed better in 1 kg vermicompost for 1 kg soil while the lowest yield has been obtained from 1 kg cowdung for 2 kg soil.

View of roof top gardenging at BARI

89. Sub project title: Effect of nitrogen, phosphorus and potassium on growth, yield and leaf quality of mulberry (ID- 545)

Bangladesh Sericulture Research and Training Institute (BSRTI), Rajshahi has been conducting the sub-project at its experimental field for the period from July 2017 to September 2018 with the objectives of i) To observe the appropriate rate of N, P and K for mulberry production, ii) To increase of mulberry leaf production and iii) To improve leaf quality of mulberry. In case of different level of N, the average maximum total leaf yield/ plant (802.0g), Chlorophyll-a (5.34 microgram/gm), Chlorophyll-b(59.19 microgram/gm) and also the biochemical properties: moisture (%), moisture retention capacity (%), crude protein (%), reducing sugar (%), total mineral (%) and total sugar (%) have been obtained from the application of 320 kg N/ha/yr + 150 kg P/ha/yr +100 kg K/ha/yr in 6-10 years old Mulberry plants. In case of different level of P, the average maximum total leaf yield/ plant (833.33g), Chlorophyll-a (2.69 microgram/gm), Chlorophyll-b(58.73 microgram/gm) and also the biochemical properties: moisture (%), moisture retention capacity (%), crude protein (%), reducing sugar (%), total mineral (%) and total sugar (%) have been obtained from the application of 300 kg N/ha/yr + 120 kg P/ha/yr +100 kg K/ha/yr in 6-10 years old Mulberry plants. In case of different level of K, the average maximum total leaf yield/ plant (941.30g), Chlorophyll-a (2.92 microgram/gm), Chlorophyll-b(63.49 microgram/gm) and also the biochemical properties: moisture (%), moisture retention capacity (%), crude protein (%), reducing sugar (%) and soluble carbohydrate (%) have been obtained from the application of 300 kg N/ha/yr + 150 kg P/ha/yr +90 kg K/ha/yr in 6-10 years old Mulberry plants.

90. Sub-project title: Symbiotic and molecular characterization of potential saline tolerant rhizobial strains and bio-fertilizer production for soybean and groundnut (ID- 559)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been conducting the sub-project at its Soil Microbiology Laboratory for the duration of May 2017 to September 2018 with the objectives of i) To isolate, identify and preserve of effective rhizobial strains collected from soybean and groundnut root nodules from saline stress areas of Bangladesh, ii) To study symbiotic, biochemical and molecular characteristics of saline stress tolerant effective rhizobial strains and their taxonomy (family, genus and species) and iii) To use these effective strains for bio-fertilizer production for soybean and groundnut cultivation. About 273 root samples from soybean and groundnut have been collected from different fields of saline soils of Bangladesh and 273 *Rhizobium* bacteria have been isolated and preserved at 4^0C and -20^0C. A total sixty salt tolerant (48 dS m^{-1}) *Rhizobium* bacteria (30 for soybean and 30 for groundnut) have been selected and bio-fertilizer has been produced. All the selected bacteria have formed nodulation. Among all bacteria, *Rhizobium* SR7 and *Rhizobium* SR15, and *Rhizobium* GR9 and *Rhizobium* GR13 have been performed better in soybean and groundnut respectively. *Rhizobium* strains have been found belongs to Rhizobiales order, Rhizobiaceae family, and genus Rhizobium.

91. Sub-project title: Improving crop yield by using polythene mulch and potassium fertilization in saline soils (ID- 570)

The sub-project is being implemented by the Patuakhali Science and Technology University (PSTU), Patuakhali at the salt affected area of Kalapara upazilla of Patuakhali and Amtoli & Taltoli upazillas of Borguna for the period from April 2017 to September 2018 with the objectives of i) To determine temporal and special variability in soil salinity in the coastal region of Bangladesh, ii) To improve crop yield through reduction of salt effect by using polythene mulch and application of K fertilizer in coastal saline soils of Bangladesh and iii) To determine the effects of salinity on the nutritional quality of crops. Polythene mulch has produced several fold higher yield of bitter gourd, snake gourd, sweet gourd, water melon and melon than the control (no mulch) in the salt affected areas of Bangladesh.

Application of potassium @ 100% recommendation has been found good to obtain better yield of vine crops in Rabi season at south coastal saline soils of Bangladesh. 100% K (STB) has been found sufficient to get optimum yield of T. Aman rice in coastal region of Bangladesh.Split application has been found somewhat better than the sole basal application of K.

92. Sub-project title: Updating of fertilizer recommendation through interpretation of research results generated by the NARS institutes (ID- 666)

The sub-project is being implemented by the Bangladesh Agricultural Research Council (BARC), Dhaka with the collaboration of NARS institutes for the duration of May 2017 to September 2018 with the objectives of i) Updating of fertilizer recommendation for crops and cropping patterns under different Agro-ecological Zones (AEZs) and ii) Publishing the updated FRG. Fertilization Recommendation Guide (FRG) -2018 has been published in English, Bengali, as Mobile apps and On-line.

93. Sub-project title: Assessing and mitigating the contamination of vegetable crops and soil under irrigation with urban wastewater (ID- 690)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been conducting the sub-project at Rajshahi and Comilla for the period from May 2017 to September 2018 with the objectives of i) To evaluate the effect of urban wastewater irrigation on the yield and contamination of vegetable crops and soil, ii) To determine health risk to the consumers of wastewater irrigated produce, and contribution of wastewater to nutrient requirement for the crops and iii) To develop an effective management practice for the use of wastewater for growing vegetable crops to minimize the microbial and other contaminations. Waste water irrigation has been found positively affected the growth and yield of all studied crops (spinach, Indian spinach and potato) while methods of irrigation has little effect on it. The difference in yield has been found between 80% and 100% RFD with waste water irrigation, and the nutrient added by wastewater has been revealed that about 20-25% of RFD could be reduced for cultivation of these crops with waste water. Crops irrigated with waste water has exhibited an increase in the concentration of macro (NPKS) and micro elements (Zn, B) in both the crops and the soils. But no consistent changes have been observed in case of heavy metals accumulation in soil. Though crop cultivation with waste water using proper irrigation techniques (BBFI for leafy vegetables, AFI for potato and drip irrigation for tomato) could minimize the bacterial (FC,TC, TABC, F. streptococci and E. coli) contamination of crops but the degree of contamination has been found still higher for its safe use.

94. Sub-project title: Intensification of conservation farming in north -west Bangladesh (ID- 697)

The sub-project is being implemented by the Bangladesh Rice Research Institute (BRRI), Gazipur at Thakurgaon and Rajshahi for the period from July 2017 to September 2018 with the objectives of i) To assess the extent of benefits of sustainable conservation farming with respect to different cropping systems and ii) To facilitate adoption of productive and sustainable conservation agriculture (CA) based technologies that are climate resilient and profitable for small holders. Transplanting of rice by rice transplanter and direct seeding of wheat and mungbean by bed planter under rice-wheat-mungbnean cropping system have saved about Tk. 15000-20000/ha. Compare with conventional, the yield of direct seeded rice in bed planting/strip tillage system has remained lower while the rice-maize-mungban system yield has been found higher in bed/strip planting system. Therefore, bed/strip planting system has saved Tk. 25000/ha compared to conventional. Jute +relay BRRI dhan39-bed/strip planted wheat system has produced similar yield with higher gross margin compared with farmers practice while jute +relay BRRI dhan71-bed/strip wheat has produced higher yield and higher profit margin compared with jute +relay BRRI dhan39 and farmers practice.

95. Sub-project title: Delineating rice yield limiting soil factors for some selected paddy soils of Bangladesh (ID- 706)

The sub-project is being implemented by the Bangladesh Rice Research Institute (BRRI), Gazipur at Habigonj, Faridpur, Rangpur and Gazipur for the duration of April 2017 to September 2018 with the objectives of i) To identify rice yield limiting factors of selected paddy soils in Habiganj, Faridpur, Rangpur and Gazipur districts, ii) To find out an appropriate nutrient ratio for maximum rice yield and iii) To find out microbial activity in soils of specific locations. OM, N, K and S content have been found the main yield limiting soil factors of Rangpur and Gazipur. Significant differences of agronomic attributes have been observed in Habiganj and Bhanga soils over Rangpur and Gazipur. Rangpur and Gazipur soils have been partially made as like as Habiganj and Bhanga soils through proper fertilization.

96. Sub-project title: Up-scaling of bio-fertilizer for improvement of soil health and rice yield in Bangladesh (ID- 707)

The sub-project is being implemented by the Bangladesh Rice Research Institute (BRRI), Gazipur at Gazipur, Barisal and Rajshahi for the period from April 2017 to September 2018 with the objectives of i) To identify beneficial rice associated bacteria from selected saline and drought prone paddy soils and ii) To upscale biofertilizer with beneficial microorganisms and its dissemination for the improvement of soil health and paddy yield. A number of 7 potential Plant Growth Promoting Bacteria (PGPB) have been identified from Gazipur (Paenibacillus polymyxa, Bacillus sp.), Komolgonj (B. subtilis), Lalmonirhat (B. mycoides, Proteus sp, B. cereus) and Patuakhali (B. pumilus). The efficacy of prepared bio-fertilizer has been determined by field application at Rajshshi, Barishal, Patuakhali, Kishoregonj and Gazipur soil. About 25-30% N and 100% TSP could be saved at T. aman and Boro season by applying prepared bio-fertilizer. The developed bio-fertilizer has been named as “BRRI-Bio-organic fertilizer”. The bio-fertilizer has been improved with these bacteria, kitchen waste, rice husk bio-char and rock phosphate. Application of this improved bio-fertilizer has saved 30% use of urea, 100% TSP fertilizer as well as improved rice yield and improved soil biology.

97. Sub-project title: Production of compost, vermicompost and tricho-compost from household solid waste and their utilization on tomato and cabbage production (ID -735)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at Gazipur, Jessore and Bogura for the period from April 2017 to September 2018 with the objectives of i) To produce compost, vermicompost and tricho-compost from household solid waste, ii) To find out effective microbes, process parameters and waste characteristics suitable for different types of composts and iii) To quantify the agronomic and economic effectiveness of compost, vermicompost and trichocompost in increasing yield of tomato and cabbage, and maintaining/improving soil fertility. About 80% (weight basis) of household solid waste has been observed as organic in nature which could be converted to compost, vermicompost and trichocompost. *Eisenia fetida*, *Eudrilus eugeniae and Perionyx excavatus* have been found efficient in decomposing agricultural waste. Best vermicompost has been produced from 75% cow dung with 25% cabbage leave. 1.5 t vermicompost/ha with 100% recommended chemical fertilizer has been produced the highest yield of cabbage and tomato.

98. Sub-project title: Effect of variety and fertilizer on cotton yield, fiber quality and seed oil content. (ID- 791)

Cotton Development Board (CDB), Dhaka has been implementing the sub-project at the five research stations of CDB located at Gazipur, Jessore, Dinajpur, Rangpur and Bandarban for the period from July 2017 to September 2018 with the objectives of i) To determine the NPK requirements of cotton variety CB 14, ii) To determine the NPK requirements of cotton variety CB 15 and iii) To know the effect of various rates of NPK on cotton seed oil content. The optimum NPK requirement for CB-14 and CB-15 has been found 175, 80 and 200 kg/ha respectively. N has positive correlation with fibre length, strength and fineness for both CB-14 and CB-15. P has positive correlation with fibre length but negative correlation with fibre strength and fineness for both CB-14 and CB-15. K has positive correlation with fibre length and strength but negative correlation with fineness for CB-14 while positive correlation with fibre length and fineness and negative correlation with SFI in case of CB-15.

99. Sub-project title: Heavy metal in the industrial polluted area: Spatial distribution, risk assessment and bacterial biogeography of contaminated soils (ID-798)

Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur has been implementing the sub-project at the industrial zone of Gazipur and Mymensingh for the duration of April 2017 to September 2018 with the objectives of i) To investigate the accumulation and spatial distribution of heavy metal in industrial contaminated soils using GIS tools and the consequence responses of crop grown in contaminated areas, ii) To illustrate the risk of heavy metal pollution merging spatial and analytical data and iii) To make a broad-scale map of patterns of bacterial biodiversity and determine the health risk index (HRI) of different heavy metals. Increasing trend of heavy metals (Zn, Cu, Pb, Cd, Ni, Fe) accumulation have been found in the agricultural soil due to the untreated industrial waste water discharges. Spatial distribution of heavy metal has been observed through preparing GIS maps. Bacterial population has been decreased dramatically in the contaminated soils as compared to the uncontaminated soils. Community structure of soil bacteria has been changed due to the contamination of agricultural soil by untreated toxic industrial effluents.

100. Sub-project title: Assessment of land degradation situation for improving soil quality and crop productivity using nuclear techniques (ID- 801)

Bangladesh Institute of Nuclear Agriculture (BINA) , Mymensingh has been executing the sub-project at all over Bangladesh for the duration of April 2017 to September 2018 with the objectives of i) To monitor the changes of physical and chemical properties of soil from 43 soil series of Bangladesh within 50 years (1967-2017). ii) To develop national data base of fallout radionuclides (^{137}Cs, ^{210}Pb, ^{226}Ra, $^{210}Pb_{ex}$, ^{238}U, ^{40}K etc.) in soil with reference value and soil erosion/deposition rate over several time scales in Bangladesh and iii) To utilize nuclear techniques for short term changes by land use practice and the effectiveness of specific soil conservation measures/management system to sustain soil fertility and crop productivity. Fallout Radio-nuclides (^{137}Cs, ^{210}Pb, ^{238}U, ^{40}K, $^{210}Pb_{ex}$ and ^{226}Ra) distribution has been observed in decreasing trend with increasing soil depths. Soil has been eroded from summit position by 2.32 t $ha^{-1}yr^{-1}$, and deposited on middle slope position (2.29 t ha^{-1} yr^{-1}), lower slope position (7.59 t ha^{-1} yr^{-1}) and bottom position (11.12 t ha^{-1} yr^{-1}) respectively. Soil has been eroded from the higher elevation and has been deposited on the lower elevation.

101. Sub-project title: Studies on the performance of vermicompost and organic materials for improving soil fertility and crop productivity (ID- 802)

Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh has been conducting the sub-project at the experimental field of BINA HQ for the period from April 2017 to September 2018 with the objectives of i) Isolation and selection of effective earthworms as rapid decomposer for different organic residues, ii) To select the suitable organic residues/combination for producing vermicompost with effective earthworms and iii) To see the effects of vermicompost on soil fertility and crop productivity. Abundance of earthworms has been observed highly dependent on soil condition. Maximum earthworms have been found in loam soil at BINA substation farm, Jamalpur (AEZ-9). Mixtures of cow dung (CD), rice straw (RS), poultry manure (PM), giant mimosa residue (GMR) at the ratio of 2.2:1.33:1.33:1.33 with the red wigglers earthworms has been found more suitable for the production of nutrient rich vermicompost among the treatment combination. Red wigglers earthworms (Eisenia fetida) have been observed more effective than mixture of local earthworms (Perionix excavates, Lumbricus rubellus, Eudrilus eugeniae etc.). About 15-25% chemical fertilizer (NPKS) could be saved either with the application of 75% NPKS with 4 t ha^{-1} vermicompost or 85% NPKS with 2 t ha^{-1} vermicompost for mustard (Binasharisha-10) and Boro rice (Binadhan-14) cultivation.

FOREST

102. Sub-project title: Development of climate resilient mangrove ecosystems in the Sundarban (ID- 301)

Bangladesh Forest Research Institute (BFRI), Chittagong has been conducting the sub-project at the Sundarban and its adjacent areas for the period from April 2017 to September 2018 with the objectives

View of Mangrove eco-system at Sundarban

of i) To develop mangrove vegetation in the coastal areas and to improve carbon sink, ii) To promote climate smart and sustainable management of coastal ecosystems through application of innovative approach for ecosystems rehabilitation and iii) Raising awareness among mangrove dwellers through capacity building programs. A total of 48,000 seeds/propagules of sundri, passur, vathkathi, jhana, kirpa, kankra, amoor, soila, baen, golpata, keora and amdhekur have been collected from the Sundarban. A total of 36,000 seedlings of 12 different mangrove species have been raised and maintained in different nurseries of the Sundarban for planting in the experimental sites. The average germination percentage of sundri, passur, vathkathi, jhana, kirpa, kankra, amoor, soila, baen, golpata, keora and amdhekur have been observed 70, 80, 95, 90, 60, 90, 90, 80,70, 90, 75 and 90 respectively. The seedlings of *Nypafruticans* have been planted during September 2017 over an area of 1.2ha in three experimental sites of the Sundarban.

103. Sub-project title: Scaling-up of farmer led agro-forestry practices for livelihood improvement and resources conservation in the Madhupur Garh area (ID- 310)

Bangladesh Agricultural University (BAU), Mymensingh has been conducting the sub-project at the Madhupur Garh area under the districts of Tangail and Mymensingh for the duration of April 2017 to September 2018 with the objectives of i) To support farmers in the improvement of production and conservation of local agroforestry practices in the project area and ii) To develop location-specific improved agroforestry practices in the project area. 10 long-duration and 10 short duration crops based agro-forestry models have been selected through baseline survey of 20 local innovative farmers and their leading agro-forestry models. The impacts of agro-forestry models on the soil nutrient status (e.g. OM, N, P, K) have been showed the trends of improving the soil quality through proper tree-crop management. Five best agro-forestry practices eg. Akashmoni-Ginger-Banana, Akashmoni- Eucalyptus-Teak-Papaya-Ginger-Pineapple-Banana, Akashmoni-Acacia hybrid- Goraneem- Gamar- Pineapple-Papaya--Banana, Akashmoni-Pineapple-Papaya-Aroid- YLB and Litchi-Pineapple-Papaya-Ginger-Banana have been selected on the basis of their performance (Net profit, BCR and LER).

104. Sub-project title: Agro-forestry for livelihood development of Jhumia community (shifting cultivators) in Chittagong Hill Tracts, Bangladesh (ID -386)

Bangladesh Forest Research Institute (BFRI), Chittagong has been implementing the sub-project at Chittagong, Cox's Bazar, Rangamati, Khagrachari and Bandarban for the period from July 2017 to September 2018 with the objectives of i) To improve the capacity of household and *jhum* land based agroforestry systems to enhance livelihoods of *Jhumia* community, ii)To introduce sustainable land use system on hill farming for optimizing the yield of food, fodder, timber, fuel-wood, bamboo, cane, medicinal plants etc. and iii) To assess socio economic

Distribution of plant sapling to the farmers at CHT

and environmental benefit based on sustainable hill farming practices. Limited knowledge on agro-forestry practices; in-adequate availability of quality saplings, fertilizer and pesticides; scarcity of water and uncertainty of market price of farm products have been identified as major problems of hill farmers in agro-forestry. Sixty hill farmers of Bandarban have been trained on agro-forestry systems, nursery establishment and pest & disease control measures. 12 hectares bamboo plantation has been established in the farmers' field with other agro-forestry species of timber, fruits and year round vegetables. 5 nurseries at farmers' field have been established for raising seedlings of different timber, non-timber and medicinal plants. Farmers have been producing seedlings of bamboos and other plants for selling and earning extra money to improve their livelihood.

105. Sub-project title: Growth and productivity assessment of agar plant (Aquilariamalaccensis Roxb.) through management practices (ID- 418)

Sylhet Agricultural University (SAU), Sylhet has been conducting the sub-project at Sujanagar union of Baralekha, Moulvibazar for the period from July 2017 to September 2018 with the objectives of i)To identify the farmers best management practices for agar plant cultivation, ii) To study the growth of agar plant and system productivity with intercropping of medicinal plants and iii) To suggest the policy and technological issues for improvement of agar production, processing and marketing.The medicinal plants have performed well in agar garden as intercrop. Among five medicinal plants Bashok and Kalomegh have been found better performance in comparison to others.High percentage of agar wood and oil have been produced from nail and insect wounding plants.

106. Sub-project title: Achieving adaptation to climate change and sustainable livelihood through Moringa based agro-forestry practice in Bangladesh (ID- 432)

Sher-e-Bangla Agricultural University (SAU), Dhaka has been executing the sub-project at its experimental field for the duration of July 2017 to September 2018 with the objectives of i)To identify major constraints of Moringa related to planting materials, production technology and marketing approaches, ii) To collect, conserve, screen, and identify potential Moringa cultivars for sustainable agroforestry farming system and iii) Cost benefit analysis and evaluation of potential Moringa based agroforestry practices for ensuring sustainable livelihood of the poor farmers. A total of 220 Moringa planting materials (cutting) have been collected from eight districts. The highest diversity of Moringa has been found in Rajshahi (4 types, seasonal, year round, pinkish coloured, and thin) followed by Pabna, Bogura and Mymensingh. The lowest diversity has been found in Manikgonj. Lack of stable market, quality planting materials, technical knowledge, and evidence of the benefits of Moringa products have been found the major constraints to further widening the plantation of Moringa. Six vegetables namely red amaranth, stem amaranth, chilli, okra, mung bean and brinjal have been grown with Moringa saplings and found all the crops can successfully be grown up to 6 months in association Moringa without significant yield loss.

107. Sub-project title: Evaluation of tree-crop interaction from existing agro-forestry systems in Sylhet region for food security by the lens of climate-smart agriculture framework (ID- 439)

Sylhet Agricultural University (SAU), Sylhet has been conducting the sub-project at Jantiapur and Biyanibazar upazillas of Sylhet and Baralekha & Srimangal upazillas of Moulvibazar for the duration of July 2017 to September 2018 with the objectives of i) To investigate long-term biophysical interactions and systems performance of existing agroforestry systems in Sylhet region, ii) To identify limiting factors, qualitative tendencies and management strategies and iii) To assess the trade-offs between trees and crops from a wide array of possible management options. Critical issues and composition of existing agro-forestry systems in Sylhet region have been identified. Adoption of agro-forestry practices and climate-smart agricultural technologies have been influenced mainly by

preferences and resource endowments of respondents. Promising climate-smart Agar based agro-forestry production technologies i.e., Pineapple+Agar, Tea+ Agar, Bilatidhania+Agar, Zinger+Agar, Turmeric+Agar, Malta+Agar based agro-forestry model for Sylhet region have been developed. Additional pineapple, zinger, turmeric, malta and / or tea could be grown without hampering the growth and development of agar tree.

108. Sub-project title: Identification and economic analysis of existing agroforestry practices in the northern region of Bangladesh for better agroforestry practices (ID- 551)

Hajee Mohammad Danesh Science & Technology University (HSTU), Dinajpur has been conducting the sub-project at Dinajpur, Nilphamari, Natore, Joypurhat and Department of Agro-forestry and Environment, HSTU for the period from July 2017 to September 2018 with the objectives of i) To identify and document the existing agroforestry practices of northern part of Bangladesh, ii) To analyse economic value of the existing agroforestry practices and iii) To suggest improved agroforestry practices for the farmers. In Kaharole upazila, 9 categories of agroforestry (AF) practices have been recorded out of 60 practices studied. Net income (NI) of orchard having AF system has been found the highest among others. Among the practices, both mango and guava based practices have been found more profitable than others. In Jaldhaka upazila, 13 major categories of practices have been identified out of 60 practices studied. Orchard having AF system has been observed more profitable than other AF systems. Among the 13 categories of practices, betel nut based AF practice has been found the highest profitable. In Panchbibi upazila, 11 major categories of practices have been identified. Net income of orchard having AF has been found higher than homestead and cropland AF. Among the practices, highest NI has been recorded in mahogany + eucalyptus based practices than that of others. In Gurudaspur upazila, 4 major categories of practices have been identified. The analysis has showed that the NI and BCR have been found the highest in orchard having AF compared to other systems. Among the practices, mango+ litchi has been recorded more profitable than others.

109. Sub-project title: Development of agro-forestry model for conversion of rice–cotton based hill farming system in the Chittagong hill tracts (ID 582)

Cotton Development Board (CDB), Dhaka has been conducting the sub-project during the period from July 2017 to September 2018 with the objectives of i) To assess the current status of jhum system, ii) To develop a model of agroforestry system to replace traditional jhum system and iii) To develop jhum farmers skill and knowledge on agroforestry system. Inter-Cropping of Rice and Cotton with Banana/Papaya have been found more profitable than Jhum crops. Banana and Papaya have been covered the fallow land after crops harvest and farmers have earned money throughout the years by selling Papaya or Banana. It seems to be better than shifting cultivation from social and environmental perspectives.

110. Sub-project title: Up-scaling of multi-tory agroforestry system for diversified production, high income and ecosystem services (ID- 595)

Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur has been conducting the sub-project at Narsinhgdi for the period from May 2017 to September 2018 with the objectives of i) To expand the multistory agroforestry system (MAFS) with the introduction of middle- and lower-story crops in a jackfruit orchard for increasing diversified products, ii) To evaluate the economic and land-use performances of MAFS and compare with the conventional practices and iii) To investigate the ecosystem services in terms of microclimatic modifications and system dynamics of the MAFS. The growth performance of understory crops in the orchard of jackfruit has been inhibited by the multistoried agro-forestry system (MAS). Among the different crop-associated jackfruit based

multistrata agroforestry systems, chilli-papaya-jackfruit has been found the highest BCR (2.33) followed by cabbage-papaya-jackfruit (2.15) while the lowest BCR has been observed in bitter gourd-papaya-jackfruit orchard (1.86) compared to un-managed open field. On an average, a jackfruit orchard has been added 23.03 kg of leaf litter to the ground, which might add 10.40 and 90.15 g/kg of N and organic matter respectively in a year. All of the crop-associated jackfruit based multistrata agroforestry systems have been observed to augment soil-N, organic carbon, organic matter and pH in compared to open unsupervised field. Shade loving crops have been grown well in multistrata agroforestry systems in compared to open fields.

View of multistory agroforestry sysrem in jackfruit orchard

111. Sub-project title: Rice-based agroforestry in Bangladesh- status and opportunities for sustainable land use system and combating future climate change challenges (ID -596)

Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur has been implementing the sub-project at the north-west region of Bangladesh for the duration of April 2017 to September 2018 with the objectives of i) Documentation of rice based agroforestry practices in the northwest region of Bangladesh, ii) Analysis of the impacts of practicing agroforestry systems in terms of land use, productivity and profitability under climate change and iii) Formulation of policy and guidelines for promotion of agroforestry in different ecosystems.Rice based agroforestry system has been observed the 2nd most dominant land use practice in the study areas. Farmers usually have been found to plant mango trees in the field and few cases in aile and aile plus field. Farmers have been believed that agroforestry system has been improved the fertility status of soil.Higher profit has been found the main reason of practicing agroforestry system and farmers have been influenced by their neighbor in practicing agroforestry system and now they have been getting the desired yield.Yield of rice has been decreased by 25-30% when grown in association with mango trees but the yield loss has been compensated by mango. However, higher yield loss has been noted in Rajshahi followed by Chapainawabgonj and Dinajpur.

112. Sub-project title: Studies on gummosis of shade trees in tea plantation and its management (ID- 815)

Bangladesh Forest Research Institute (BFRI), Chittagong has been executing the sub-project at the different locations of Chittagong for the period from May 2017 to September 2018 with the objectives of i) To survey the incidence of gummosis of shade trees in major tea plantation areas of Bangladesh, ii) To identify the causal agents (insect and pathogen) of gummosis and iii) To determine suitable control measures of gummosis. The highest gummosis disease incidence (35.25%) has been recorded in *A. procera* at Uddalia tea garden, Fatikchari, Chittagong and the lowest (4.94%) has been recorded in *Samanea saman* at BTRI substation, Fatikchari, Chittagong. The pathogenecity test has proved that gummosis has been caused by *Lasiodiplodia crassispora* and *Botryodiplodia theobromae*. RH (90-95%), pH (6-8) and Temperature (25-30 °C) have been found favorable for CG (Conidial germination) and MG (Mycelial Growth) of *Lasiodiplodia crassispora* and *Botryodiplodia theobromae.* Concentration of 2-3% glucose and sucrose has been observed the best for CG and MG, and sucrose has been found better than glucose. PDA (Potato dextrose agar) medium has been observed the best for mycelial growth of *Lasiodiplodia crassispora* and *Botryodiplodia theobromae*.

Chemical fungicides Autostin, ARBA, Knowing and Bordeaux mixture have been found effective to control gummosis disease of *A. procera*, *A. lebek* and *Samanea saman. Trichoderma harzianum* has also been observed effective as a biocontrol agent against gummosis disease of *A. procera*, *A. lebek* and *Samanea saman*

AGRICULTURAL ENGINEERING

113. Sub-project title: Improvement of coconut harvesting and de-husking machine (ID- 307)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at the different upazillas of Barisal, Noakhali, Patuakhali, Khulna, Bagerhat, Pirojpur and Gazipur for the period from April 2017 to September 2018 with the objectives of i) To conduct the baseline survey on present status of harvesting and de-husking practices of coconut in selected major

Coconut de-husking machine developrd by BARI

coconut growing areas of Bangladesh, ii) To improve coconut climber & de-husker,and evaluate the performance of climber and de-husker along with economic feasibility and iii) To conduct training and demonstration of climber and de-husker at users level in the project areas. Improved coconut tree climber and coconut de-husking machines have been developed with locally available materials for enhancing the coconut harvesting and de- husking. Average climbing speed of the skilled operator in manual practice has been found 0.4 m/s while average capacity of de-husker has been observed 309 nuts per hour at the speed of 27rpm. The payback period of de-husker has been observed 80 days and the benefit cost ratio has been found 1.33.

114. Sub-project title: Develop a hydrogeological framework and a sustainable crop establishment period for haor areas of Bangladesh (ID- 473)

Sylhet Agricultural University (SAU), Sylhet has been executing the sub-project at Hakaluki, Fenchugonj, Sylhet for the period from April 2017 to September 2018 with the objectives of i) To investigate the influence of climatic variability on haor water dynamics, ii) To investigate the geo-structural and hydraulic characteristics of aquifer, iii) To assess land suitability and cropping practice by application of GIS in haor area and iv) To develop a crop establishment period and the water management package suitable for haor area. Cultivation of non rice crops as well as Aus has not been possible before November and after May respectively. Early maturing Aus may be cultivated with irrigation if normal flooding has not been expected within three months. Rainfall difference between the driest and moist month has been recorded 692mm. Average annual temperature, temperature changes and water level increase have been observed 24.9^{0}c, @ 18.4^{0}c and up to 1.5m respectively. Cultivable lands have been observed inundated at the beginning of flood. Higher price of agricultural inputs, lack of quality seed, labour, storage & transportation facility, institutional support and income instability have been found the major constraints of farmers.

115. Sub-project title: Improving the performance of mechanized seeding through innovations in seed metering system (ID- 491)

The sub-project is being conducted by the Bangladesh Agricultural Research Institute (BARI), Gazipur at its FMPE division for the duration of May 2017 to September 2018 with the objectives of i) Benchmark the performance of maize seed meters and identify the critical design parameters using a high speed camera at the 'Tillage-cum-Seeding' laboratory, ii) Design and develop a precision seed metering system for maize planting and iii) Fabricate a seeder incorporating the precision seed metering system and validate its performance through on-station field trial.The Chinese Precision Seed Meter has been found better than the BS, WS and VMP types.Use of Precision Seed Meter has been recommended for planting maize with or w/o tillage.The precision seeding system has been found capable to save time & cost as well as reduce drudgery compared to traditional manual planting.

116. Sub-project title: Development of modern reeling machine and its use for quality and quantity raw silk production in the field (ID- 519)

The sub-project is being conducted by the Bangladesh Sericulture Research and Training Institute (BSRTI), Rajshahi at its campus for the period from April 2017 to September 2018 with the objectives of i) To produce quality raw silk through developing modern reeling machine, ii) To improve renditta and iii) To minimize the reeling cost. Comparatively improved reeling machine has been designed and fabricated. The reeling performance of the fabricated reeling machine has been found superior than the existing reeling machine. Quality raw silk production cost has been found less than the existing reeling machine. Renditta has been comparatively improved.

117. Sub-project title: Design and development of a compensated emitter for efficient drip irrigation system in Bangladesh (ID- 548)

The sub-project is being conducted by the Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur at its campus for the period from April 2017 to September 2018 with the objectives of i) To design a labyrinth type pressure compensated drip emitter for micro irrigation, ii) To manufacture emitters and improve their water application uniformity indices and iii) To identify

the backward and forward linkages for a sustainable business of drip products. Pressure compensated emitter has been designed. The manufacturing flow variation along the lateral in this system has been found less than 15% (Excellent according to ISO 9261). This emitter has been found able to work under very low pressure. Initial investment required for the production of this emitter by small scale manufacturer has been found to be BDT 35000.

118. Sub-project title: Design and development of power operated oil palm fruit stripper (ID-576)

The sub-project is being implemented by the Bangladesh Agricultural University (BAU), Mymensingh at the Engineering Workshop, Department of Farm Power and Machinery of BAU for the period from April 2017 to September 2018 with the objectives of i) To determine effective treatments (temperature, sterilization time etc.) for efficient fruit separation, ii) To design and develop different parts of a oil palm stripper, iii) To evaluate the working performance of the machine in the Departmental Laboratory. Power operated Oil Palm fruit stripper has been designed, fabricated and assembled. The best performance has been resulted from the sterilization time 15 minutes at 120^0 c temperature.The efficiency and capacity of the machine has been found 98.89% and 0.81 ton/hr, respectively for the sterilization time 15 minutes at 120^0c. The inclination of the fruit outlet tray should be slightly increased (current inclination is 10^0 which need to be increased by 20^0) and the diameter of the cylinder should be increased also for big size branch (current diameter is 460 mm which should be increased by 550 mm).

119. Sub-project title: Developing a model-based water management plan for haor wetlands of Bangladesh to reduce the vulnerability of Boro rice crop to flash floods (ID-624)

The sub-project is being implemented by the Bangladesh Agricultural University (BAU), Mymensingh at haors near Shimul Buck village in Itna upazilla of Kishoregonj for the duration of April 2017 to September 2018 with the objectives of i) Instrumenting some representative haors for monitoring real time hydro-meteorological data, ii) Developing a distributed physics-based model for simulating haor hydrology and rice yield and iii) Developing haor water management scenarios for different climate change induced hydrological alternations. About 10% area of the Agolpa haor has been flooded due to local rainfall during the harvesting time (May 2018) whereas overflowing of the river Dhanu has been claimed 17%. Elevating the height of field bunds has been observed an excellent measure to reduce the vulnerability of Boro crop to early floods that has been generated from local rainfall within the haor catchment. This management approach has been found the potential to decrease inundated area of the haor by 89%. The study site has been projected to be experiencing increasing rainfall and temperature in the future period (2031-2050) with respect to the baseline period (1991-2010). Present flooding risk of Boro rice has been projected to be increasing in the future period particularly during the harvesting time.

120. Sub-project title: Improvement of water productivity for enhancing crop production in water scare area of north-west Bangladesh (ID- 696)

The sub-project is being implemented by the Bangladesh Rice Research Institute (BRRI), Gazipur at Chatmohar, Pabna for the period from June 2017 to September 2018 with the objectives of i) To maximum utilization of water resources for crop production in water scare areas and ii) To improve water productivity by appropriate water management practices. Monitoring data of ground water has been indicated that the aquifer of North-West Bangladesh is unconfined. Storage coefficient,

transmissivity, hydraulic conductivity of aquifer should be studied for further planning of crop cultivation as ground water has been the only source of irrigation in the North-West of Bangladesh. HYV submergence tolerance variety BRRI dhan 51 and BRRI dhan 52 have been accepted by the farmers during aman season with local cultivar Zonakra. The main cash crops onion, garlic, onion seed and wheat have not been suffered by BRRI dhan 51 and BRRI dhan 52. Farmers have been interested to cultivate BRRI dhan 48 after non-rice crops.

121. Sub-project title: Improvement and validation of BRRI developed head feed mini combine harvester (ID- 705)

The sub-project is being implemented by the Bangladesh Rice Research Institute (BRRI), Gazipur at its Engeering Workshop, Gazipur and Chuadanga for the period from April 2017 to September 2018 with the objectives of i) To modify the BRRI developed combine harvester, ii) To test and evaluation of modified combine harvester at selected locations and iii) To validate of the developed technology to the end users. Prototype of BRRI developed head mini combine harvester has been finalized and fabricated. Capacity of two local manufacturing workshops has been enhanced. A total of four awareness program with 60 end users have been conducted. Two validation programme has been conducted.

122. Sub-project title: Development of shelf stable value added products from onion, garlic and ginger (ID- 728)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at Bogura, Lalmonirhat, Rajshahi, Pabna, Faridpur and Khagrachari for the duration of April 2017 to September 2018 with the objectives of i) To identify post-harvest practices and to determine the post-harvest losses of onion, garlic and ginger in farmers field, ii) To study storage stability and determine organoleptic acceptability of developed products and iii) To minimize the post-harvest losses and optimize process parameter to obtain high quality process products of onion, garlic and ginger. The traditional storage practices of onion, garlic and ginger has not been found good enough to minimize the postharvest losses. High quality shelf-stable onion, garlic and ginger products have been developed by utilizing available low cost dehydration processes and post-harvest losses of these spices have been reduced to an acceptable level. The storage stability and organoleptic acceptability of these developed products have been found satisfactory. Farmers have been interested to use these processed spices in curry.

Procesing of spices products at SRO, BARI, Bogora

123. Sub-project title: Design and development of efficient and low cost sugarcane power crusher for goor production (ID- 748)

The sub-project is being implemented by the Bangladesh Sugar crop Research Institute (BSRI), Pabna at BSRI Agricultural Engineering Workshop, Agricultural Machineries Manufacturing Workshops in Dhaka, Bogura, Sylhet, Faridpur, Chuadanga and Gazipur for manufacturing and testing for the period from April 2017 to September 2018 with the objectives of i) Design and development of sugarcane crusher for efficient juice extraction, ii) Development of a low cost sugarcane crusher and iii) Reducing process loss of goor production. Four types of sugarcane power crusher have been designed and fabricated. Juice extraction capacity of developed BSRI sugarcane power crusher has been observed 50 to 60% of cane weight. Crushing capacity of BSRI sugarcane power crushers have been found 250 kg to 500 kg per hour. Power requirement of BSRI sugarcane power crusher has been observed lesser than conventional crusher.

124. Sub-project title: Innovation of dyed jute knitted fabric in textile technical sectors (ID-754)

Bangladesh Jute Research Institute (BJRI), Dhaka has been implementing the sub-project at its Pilot Plant and Processing Lab. for the duration of October 2017 to September 2018 with the objectives of i) To produce innovative knitted technical value added jute fabric of plain and rib structure with desired aesthetic and performance characteristic, ii) To produce different types of value added and attractive garments items such as ladies suit, jeans suit, cardigan etc by suing those knitted fabrics and iii) To create a new field of job which will contribute to partially eliminate the poverty and will upgrade the economy of the country also particularly in the jute sector.Different types of value added and attractive garments items like ladies gown, sweater, cardigan and ladies suits have been produced by using jute knitted fabric. Value added and attractive garments have been produced by using Flat Bed Knitting Machine, Circular Knitting Machine and other Knitting Machine.

125. Sub-project title: Development of a low cost battery operated rotary type upland weeder (ID- 774)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at Gazipur, Sherpur, Rajshahi and Patuakhali for the period from April 2017 to September 2018 with the objectives of i) To develop a cost effective rotary weeder for medium and small scale farmers, ii) To evaluate the performances of weeder in research field and iii) To disseminate the technology among the farmers by adaptive trial in farmers' field. Battery operated rotary type upland weeder has been fabricated by locally available materials. Yield difference among the three weeding methods has not been found significant. Number of labour requirement has been observed one fifth compare to other methods. Cost of weeding has been observed almost one fourth to hand weeding. Area coverage of weeder has been found 17 decimal/ hour. Mean value of weeding index has been found very close to hand weeding. Plant damage has been observed very few at low height and low canopy crop. Battery life has been found one year but need to change monthly.

126. Sub-project title: Design and development of jute-cotton reinforced polimer composite for rural poultry housing (ID-780)

Bangladesh Jute Research Institute (BJRI), Dhaka has been executing the sub-project at its Textile Physics Laboratory for the period of November 2017 to September 2018 with the objectives of i) To increase diversified usages of jute fibres, ii) To produce jute-cotton reinforced polymer corrugated sheet for rural poultry housing and iii) To reduce inner temperature of poultry house. 60% jute and 40%

cotton blended union fabrics have been found the most suitable for composites fabrication to diversify the uses of jute fibres.Jute composites have been fabricated by varying the sample thickness (3 mm and 4 mm), MEKP (methyl ethyl keton peroxide) wt%, and nano-cellulose wt%.The best weight proportion of methyl ethyl keton peroxide, nano-cellulose and the optimum thickness of the composites have been observed 1.5%, 6.0% and 3mm respectively.

127. Sub-project title: Development and dissemination of fertilizer deep placement applicator for increasing frtilizer use efficiency and farm productivity (ID- 811)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at Faridpur, Barisal and Bhola for the period from April 2017 to September 2018 with the objectives of i) To develop and promote fertilizer applicator for fertilizer deep placement, ii) To increase fertilizer use efficiency by fertilizer deep placement under the soil and iii) To increase crop production with saving of fertilizer and environment pollution. Single row filled urea applicator has been designed, tested and manufacturing has been under processing. Injector type prill urea applicator has been developed. Linkage has been developed in supplying packet USG to the local fertilizer businessmen. Yield has been increased due to deep placement of urea at the project locations.

128. Sub-project title: Development and adaptation of water saving irrigation techniques for upland crops (ID- 814)

The sub-project is being implemented by the Bangladesh Agricultural Research Institute (BARI), Gazipur at Dinajpur and Khulna for the period from April 2017 to September 2018 with the objectives of i) To develop raised bed alternate and fixed furrow irrigation techniques for upland major crops in drought and salt prone areas, respectively, ii) To develop drip irrigation systems with higher water distribution uniformity and water use efficiency for high value upland crops and iii) To validate and adapt the site specific water saving technologies at farmers' field condition for crop production. New emitter with low pressure (gravity) drip irrigation system has been developed for efficient application of water to individual plant. The hydraulic performance of the developed drip irrigation system has been found better at 1.5 to 2 m operating head with various slopes of 0% and 1%, and emitter discharge rate has been found from 3 to 5 liter/ hour. Alternate / Fixed furrow irrigation techniques have saved seasonal water use of potato, maize, sunflower, brinjal from 24 to 32% and it has also improved water productivity from 28 to 40% while drip irrigation at 3-5 days interval has saved water use of brinjal, tomato, watermelon from 38 to 47% and has improved water productivity from 50 to 60% compared to traditional irrigation practices. Water saving techniques has the potential to save water without any sacrifice in yield of crops. Because of insufficiency of surface and ground water resources and raising salinity, these efficient irrigation techniques should be used in different rabi crops at drought and coastal salt affected areas of Bangladesh for sustainable food security.

FISHERIES

129. Sub-project title: Breeding biology and induced breeding technique of the freshwater gangmagur, Hemibagrus menoda (Hamilton, 1822) (ID-305)

The sub-project is being implemented by the Bangladesh Agricultural University (BAU), Mymensingh at the Fisheries Laboratory Complex, Faculty of Fisheries, BAU for the period of May 2017 to September 2018 with the objectives of i) To study the reproductive cycle of *H. menoda* by Fecundity,

Gonado Somatic Index (GSI) and gonadal histology and ii) To develop induced breeding technique of *H. menoda* using inducing hormones. Spawning of gangmagur took place once in a year but with longer duration spawning from May to July. Successful ovulation has been occurred in the females injected 24, 25, 26, and 27 mg PG and 3500, 4500, 5500 and 6500 IU HCG /kg body weight. Best spawning outcomes have been obtained from spawners injected double dose of 3500IU and 26 mg HCG and PG/kg body weight, respectively, in a 2♂:1♀ ratio.

130. Sub-project title: Effects of vacuum and modified atmosphere packaging on microbiological and biochemical properties of fresh fish stored at refrigeration temperature (4˚C) (ID-316)

University of Rajshahi (RU), Rajshahi has been executing the sub-project at its Department of Fisheries for the duration of June 2017 to September 2018 with the objectives of i) To know the consumer's acceptability of MAP packaged whole dressed or portion of fish in the market, ii) To determine the microbiological and biochemical quality of whole dressed or portion of fish stored under vacuum and different modified atmosphere packaging at 4˚C and iii) To determine the overall quality and shelf-life of whole dressed or portion of fish stored under vacuum and different modified atmosphere packaging at 4˚C. Most of the consumers in the superstores of Dhaka have been observed highly educated and job holder and spend around 1000-5000 taka/m in purchasing fish. Most of the superstore consumers (58%) have preferred to buy refrigerated packaged fish if available. The shelf-life of sliced tilapia fish has been determined at approximately 7 days for unpack and N_2 pack sample while 13 days for vacuum pack sample under refrigerated storage. The shelf-life of sliced pangus fish has been determined at approximately 7 days for unpack and N_2 pack sample while 10 days for vacuum pack sample under refrigerated storage.

131. Sub-project title: Development of green mussel Perna viridis farming system in coastal areas for boosting blue economy of Bangladesh (ID-333)

The sub-project is being conducted by the Chittagong Veterinary and Animal Science University, Chittagong at the Bay of Bengal in Cox's Bazar for the period of April 2017 to September 2018 with the objectives of i) To apply site capability rating system for fast and effective evaluation of potential farming sites of green mussel in coastal areas of Bangladesh, ii) To obtain near real-time data on feeding behaviour, larval occurrence, abundance of seed and seasonal variation of spat settlement density with different substrates of green mussel in coastal habitat in Bangladesh and iii) To develop appropriate green mussel culture technology and profitability model in context of Bangladesh by piloting different culture systems at potentially suitable farming areas. Maheshkali channel and Naaf River Estuary have been found the most suitable site for green mussel farming in Bangladesh. Green mussel selectively has been fed on plankton and such ingestion has been found to vary with season, size and sex. The major spawning season has been observed from January to March and a minor spawning has been observed in July to August in Bangladesh waters. Long-lining rope culture and cage culture have been found the best culture techniques. Green mussel rich in nutrients and good source of protein, essential amino acids and polyunsaturated fatty acids. Green mussel harvested in winter season has been found richer with these nutrients.

132. Sub-project title: Business opportunities of ornamental fisheries in Bangladesh: Development of a production and economic assessment model (ID-363)

Bangladesh Agricultural University (BAU), Mymensingh has been executing the sub-project at the Dhaka and Mymensingh Cities for the duration of July 2017 to September 2018 with the objectives of i) Social and economic parameters of community determined and monitored, local knowledge and needs identified, existing consumer preference vis-a-vis marketing strategies adopted by ornamental

fish aquarium business service providers explored, ii) Develop a production and economic model of ornamental fish business including profitability analysis and iii) Design strategies for promoting ornamental fish aquarium business service. Baseline information on the present status of ornamental fish business in Bangladesh has been collected. Zebrafish breeding technique in the laboratory has been developed. Goldfish breeding technique in the backyard hatchery has also been developed.

133. Sub-project title: Study on quality of fish feed, brood use and fingerlings produce in commercial fish farm of Bangladesh (364)

The sub-project is being carried out by the Bangladesh Agricultural University (BAU), Mymensingh at the commercial hatchery owners and fish farmers in Bangladesh for the duration of September 2017 to September 2018 with the objectives: of i) To evaluate the quality of feed (the major ingredients) used in the fish farms and to assess the performance of brood stocks and fingerlings of selected carp, catfish and perch farmed in Bangladesh, ii) To develop a set of principles for the hatchery owners on how to maintain and improve the quality of brood stock and how to produce fish seed with prime quality that ensure high survival, good growth, and best disease resistance in the grow-out and iii) To prepare a guideline for the feed producers (manufacturers) and fish feed users (fish farmers & hatchery owners) on using feed ingredients and maintaining quality. Most of the commercial fish farms owners have been used commercial feed instead of homemade feeds. Manufacturers' declared proximate composition of most of the collected feed samples has been either lower or higher. Brood stocks and fries of river, govt. hatcheries and BFRI have been found better than private hatcheries. Several abnormalities of embryo and deformities of larvae have been caused in no brood stock and with brood stock but not good management compared to maintain brood stock properly.

134. Sub-project title: Seed production of Bhagna, Labeo ariza (Hamilton, 1807) through line breeding trial in Bangladesh (ID-397)

The sub-project is being executed by the Bangladesh Agricultural University (BAU) at Mymensingh with the wild Bhagna fishes of Kangsha and Attrai rivers for the period of April 2017 to September 2018 with the objectives of i) To domesticate the wild sources of *L. ariza* for gonadal maturation under captive condition and ii) To perform the induced breeding of *L. ariza* under different line breeding trial. Growth rate of Bhagna has been observed satisfactory but as it is a minor carp it does not grow as fast as the other commercially cultured carp species in Bangladesh. Among the six different developed lines, line-4 (Kangsha ♀ x Attrai ♂) has been found best in terms of length and weight gain in the larval rearing period of 60 days. Line-4 has the highest number of small new muscle fibre (mosaic hyperplasia) in comparison to other developed lines. Line-4 may be used as a base population for the production of good quality seed & brood stock of Bhagna (L. ariza) for better growth performance.

135. Sub-project title: Development of sustainable aquaculture system in the inundated low-laying agriculture land in the coastal region of Bangladesh (ID-410)

Patuakhali Science and Technology University (PSTU), Patuakhali has been conducting the sub-project at the Banaripara Upazila of Barisal for the duration of April 2017 to September 2018 with the objectives of i) To utilize *Hygroryza aristata* floating grass as fish feed, ii) To utilize the submerged low-laying agriculture land and tidal water for emerging aquaculture system with maintaining good water quality, iii) To determine the proximate composition of *Hygroryza aristata* and fish in relation to growth performance and iv) To examine biological, economical and environmental advantages achieved through new interventions proposed aquaculture systems. *Hygroryza aristata* floating grass has been utilized as fish feed directly which is a new initiative for aquaculture in the fisheries sector of Bangladesh. Aquaculture system has been established in the open water of low-laying agriculture land through maintaining water quality for good aquaculture practice by exchange water daily through tidal

action. Fish production has been observed possible without fish feed cost by using *Hygroryza aristata* floating grass except labor cost, and this technology might reduced 3.54 times fish production cost and may be benefited 5.91 times more.

136. Sub-project title: Study on environmental and socio-economic impact of Daudkandi model floodplain fisheries management (ID-462)

The sub-project is being implemented by the Sustainable Development Associates (SDA), Dhaka at the Daudkandi upazilla of Comilla for the period of April 2017 to September 2018 with the objectives of i) Assess the impact of Daudkandi model of community floodplain aquaculture on fish population, ii) Assess the impact of Daudkandi model of community floodplain aquaculture on water quality and cropping system and iii) Assess the impact of Daudkandi model of community floodplain aquaculture on the livelihood of fishing community. Fish production, income, employment, rice production and diversification of business have been increased while rice production cost has been reduced. Disparity, shifting occupation and social conflict (due to control over water) etc. have increased. Environmental degradation as well as loss of biodiversity has been happened due to use of pesticides and industrial affluent. However, this model could be adopted in other floodplains of Bangladesh.

137. Sub-project title: Production of Asian Seabass (Lates calcarifer) in brackish and freshwater earthen pond under natural and artificial feeding regime in South-west Coastal zone of Bangladesh (ID-464)

The sub-project is being executed by the Patuakhali Science and Technology University (PSTU), Patuakhali at the South-West Coastal Region of Bangladesh for the period of June 2017 to September 2018 with the objectives of i) To compare growth and survival of Asian seabass in brackish and freshwater pond, ii) To develop suitable feeding regime for seabass aquaculture and iii) To determine optimum stocking density of seabass in captive aquaculture system. Recorded physical and chemical parameters of water have been observed in suitable range. Higher final weight has been recorded at a density of 25 seabass / decimal in monoculture system. Final weight has been found higher in polyculture than monoculture. Higher final weight in fresh water environment has been observed through adding Nacl with artificial feed.

138. Sub-project title: DNA barcoding of freshwater fishes of Bangladesh: Implication for conservation and management (ID-471)

The sub-project is being implemented by the University of Dhaka, Dhaka at its Department of Zoology for the period of April 2017 to September 2018 with the objectives of i) To know the genetic diversity of freshwater fishes of Bangladesh exploring the mitochondrial Cytochrome C Oxidase Subunit I (COI) gene, ii) To develop a standardized reference library as 'Bangladesh Barcode of Life' Data base system to store all the DNA barcode data for the use of researchers, students and policy makers and iii) To know the conservation status and recommendation on management of genetic diversity of freshwater fishes of Bangladesh. A total of 225 specimens belong to 136 species have been collected and identified during the study period (May 2017- June 2018). 211 DNA sequences have been generated of 136 species belong to 17 Orders of 60 Families. Gene Bank accessions of 136 species have already been completed. At least seven new species have been recorded and reported (*Clupisoma prateri, Batasio convexirostrum, Badis tuivaiei, Botia rostrata, Schistura fasciolata, Devario annandalei and Oryzias javanicus*). A standardized reference library as 'Bangladesh Barcode of Life' (www.bdbol.net) Data base system has been developed for the use of researchers, students and policy makers.

139. Sub-project title: Management of indigenous fishes in wetland (Gajner Beel, Pabna) ecosystem (ID-484)

University of Rajshahi, Rajshahi has been conducting the sub-project at the Gajner Beel, Pabna for the period of June 2017 to September 2018 with the objectives of i) To find out the fish diversity with emphasis on indigenous fish species composition in relation to fishing gear in the Gajner *Beel*, ii) To identify the causal factors for threatening/ declining of indigenous fish species in the Gajner *Beel* and iii)To estimate the size at sexual maturity and spawning season of selective indigenous fishes in the Gajner *Beel*. A total of 51 fish species have been found in the Gajner *Beel* wetland ecosystem, where 45, 03 and 01 fishes have been observed as indigenous, Indian major carps and exotic species respectively. Current Jal and monofilament mosquito net have been found the most destructive fishing gears for indigenous fishes in the Gajner *beel*. Major threats to the fisheries resources in the Ganjner *beel* have been observed the reduction of water level, destructive fishing gears, indiscriminate killing of fish fry, fingerlings and gravid fish, habitat destruction and climate change etc. Size at sexual maturity has been estimated for a total of 23 indigenous fish species from the Gajner *beel*, where the mean value has been observed 9.4 cm total length with 95% confidence level having 7.25 to 11.61 cm. Spawning season for most of the fishes has been extended from March to September with its peak in June –July.

140. Sub-project title: Mass seed production and culture technology of threatened fish Cirrhinus reba for sustainable aquaculture in Bangladesh (ID-488)

The sub-project is being conducted by the Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur at the Department of Fisheries Biology and Genetics, HSTU and Fisheries Field Research Complex, Caritas, Dinajpur for the duration of July 2017 to September 2018

View of Cirrhinus reba fish

with the objectives of i) To assess the genetic variation of *C. reba* collected from different region of Bangladesh for quality broodstock management , ii) To develop artificial breeding technique for *C. reba* and iii) Crossbreeding of *C. reba* for the genetic improvement of the stocks of Dinajpur region. Morphological and genetic variations of wild stocks of *C. reba* among the natural populations in Dinajpur, Bogura, Mymensingh and Jessore have been assessed. Induced breeding of *C. reba* by applying pituitary gland extract @ of 1.5 mg/kg as 1st dose for female, 7.5 mg/kg as the 2nd dose, and 2 mg/kg for male has been done successfully. Seven lines of C. reba by mating between and within different wild stocks have been developed. Within population, the stocks of Dinajpur and Mymensingh have showed better performances, and within populations, the females of Dinajpur and males of Mymensigh have showed the highest performances in terms of ovulation, fertilization and hatching rate. Development of larval rearing and nursery management technique for fingerling production, using of boiled egg yolk for the 1st feeding, traditional handmade feeds and manuring have been found effective for fingerling production. C. reba sperm have showed high sensitivity to salinity gradients during motility activation. Sperm have been found motile for 24 seconds at 0.1% NaCl but motility endured over 20 minutes at 0.8% NaCl. Exposure of embryo to pesticide have resulted degeneration of nucleus leading to embryo death.

141. Sub-project title:Development of quality value added fish products and utilization of by-products (ID-489)

The sub-project is being executed by the Sylhet Agricultural University (SAU), Sylhet at the Sylhet and Cox's Bazar for the period of April 2017 to September 2018 with the objectives of i) Development of new fish products and their quality assurance , ii) Proper utilization of fish by-products and iii) Value addition to fish product and by-product. Two waste sources eg.shrimp (23190.24 ton/year) and fish (17605.71 ton/year) have been found predominant. The highest amount of shrimp waste has been found in the seafood processing industries of Khulna (12016 ton/year) followed by Chittagonj (7965ton/year), Cox,s Bazar (2155ton/year), Dhaka (771 ton/year) and Sylhet (284 ton/year) regions respectively. Egg has been observed the most frequently consumed, 77% respondents have eaten egg once daily. The chicken has been found the second most consumed (62%) whereas, fish in the third place (59%). Mutton has been observed in the fourth place of consumption frequency level. More fish has been consumed in Khulna division followed by Barisal and Sylhet. Considering all aspects, fish burger prepared by using 70% fish mince has been found better.

142. Sub-project title: Characterization of commercial probiotics using for fish and shrimp culture in Bangladesh (ID-493)

Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur has been executing the sub-project at the Department of Fisheries Biology & Aquatic Environment, BSMRAU with the commercial probiotics using for aquaculture in Bangladesh for the duration of April 2017 to September 2018 with the objectives of i) To enlist probiotics using for aquaculture in Bangladesh, ii) To isolate and characterize bacteria from commercial probiotics using for aquaculture and iii) To determine the probiotic properties and antibiotic susceptibilities of different bacterial isolates. 31 commercial aqua probiotics have been collected and enlisted with the product level information. 118 isolates have been isolated from different commercial probiotics using selective media. Biochemical characterizations of some isolates including gram staining, catalase and oxidase have been completed. Most of the tested isolates have showed moderate tolerance in acidic condition whereas highly in bile salt. Most of the isolates have showed diverse range of susceptibilities in different kind of antibiotics. 30 isolates from different commercial probiotics have been tested for hemolytic activity but no activity has been found.

143. Sub-project title: Evaluation of the suitability and efficacy of potato and wheat as probiotic compounds on the growth performance, survivality and tissue composition of Labeo rohita and Catla catla (ID-497)

The sub-project is being carried out by the Bangladesh Agricultural University(BAU), Mymensingh at its Department of Aquaculture for the period of July 2017 to September 2018 with the objectives of i) To determine the effect of potato and wheat as prebiotics on the growth and production performances of *Labeo rohita* and *Catla catla*, ii) To evaluate the potato and wheat supplemented feed on the tissue composition of *Labeo rohita* and *Catla catla* and iii) To know the effect of potato and wheat on the survivality of *Labeo rohita* and *Catla catla*. Wheat and potato as prebiotic supplement has been enhanced the growth performance of rohu and catla. In both cases inclusion of 15% potato and wheat has showed the best performance. 15% prebiotic compound has showed the most bacterial load. Potato and wheat may be used as prebiotic supplement to enhance the growth performances of rohu and catla and may be used for other species.

144. Sub-project title: Molecular identification of local and exotic strains of koi (Anabas testudineus) for strategic conservation management (ID-502)

The sub-project is being implemented by the Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur at its Department of Genetics and Fish Breeding for the period of July 2017 to September 2018 with the objectives of i) To study complete mitochondrial genome of local and exotic koi (*A. testudineus*) in Bangladesh, ii) To study genetic structure of local and exotic koi population in Bangladesh and iii) Molecular marker development for the prompt identification of quality broodstock of local and exotic koi for breeding program. Local and exotic koi have been identified using mtDNACR gene sequences. Mitochondrial CR gene has been used as molecular marker for koi fish in Bangladesh. Information about cross koi from the field can be diagnosed.

145. Sub-project title: Development of nanomaterial mediated feed for improving growth and immunity of fishes (ID-510)

University of Rajshahi, Rajshahi has been implementing the sub-project at the Department of Agronomy & Agricultural Extension and Department of Fisheries for the period of July 2017 to September 2018 with the objectives of i) Preparation of shape and size controlled nanoparticles for different metals under oilbath heating, ii) Synthesis of nanomaterials (micronutrient) mediated feed for disease free fish growth and development and iii) To observe growth performance, meat quality (proximate compositions), haematological parameters and immune responses of fishes by adding different doses of nanoparticles in an experimental diet. More active nanoparticles for different metals under oil bath heating have been prepared. Active series of NPs have been found- Zn> Fe > Cu. Nanomaterials mediated feed for disease free fish growth has been developed.

146. Sub-project title: Induction of breeding and larval rearing of *Botia dario and Lepidocephalichthys guntea* for aquaculture and recreational use in Bangladesh (ID-553)

The sub-project is being implemented by the Noakhali Science and Technology University (NSTU), Noakhali at Noakhali for the period of August 2017 to September 2018 with the objectives of i)To develop the breeding technique of *Botia dario* and *Lepidocephalichthys guntea.* through optimizing hormones for successful induced breeding, ii) To develop nursery management techniques and iii) To assess their feasibility for commercial and recreational aquaculture. Breeding season (Monsoon-from April to mid July) of L.guntia and Botia dario have been identified. Gonadosomatic index (GSI) of the targeted species have been measured. Dose of hormone for induce breeding of L. guntia has been optimized. The viable fry of L. guntia has been produced. Nutritional value of those species has been measured.

147. Sub-project title: Impact of aquaculture on agricultural production in greater Noakhali districts (ID-587)

Noakhali Science and Technology University (NSTU), Noakhali has been implementing the sub-project at Noakhali, Laxmipur and Feni for the period of April 2017 to September 2018 with the objectives of i) To identify the status of agricultural production and productivity of the adjacent aquaculture farm, ii) To determine the soil and water quality of the adjacent aquaculture farm and iii) To assess the impacts of aquaculture farming on livelihood status of non-aquaculture farmers. High content of organic matter, organic carbon, total nitrogen and salinity have been released from fish farm to nearby agricultural land that has been influenced the productivity of agriculture in Greater Noakhali district. Many crops have not been produced after the establishment of fish farm except rice. Larger aquaculture farms with hatcheries have found detrimental effects on its nearby waterlogged agricultural land through less crop production where the small farms helps to get more agricultural productions.

148. Sub-project title: DNA barcoding and metabarcoding of coral associated fish and zooplankton community of Saint Martin's Island for effective conservation of marine life (ID-609)

The sub-project is being implemented by the Sher-e-Bangla Agricultural University (SAU), Dhaka at Saint Martin's Island of Bangladesh for the duration of April 2017 to September 2018 with the objectives of i) To build a precise inventory of coral associated fish based on DNA barcoding along with morphometrics, ii) To assess population genetic structure of an ecologically/commercially important fish or shell fish species found in the Island area and iii) To assess the diversity of zooplankton by DNA metabarcoding through next generation sequencing (NGS). 109 coral fish species have been identified morphologically and 32 new species have been recorded in Bangladesh marine water. One fish species Cryptocentus maudae has been extended its new distribution from South-west Pacific to the Bay of Bengal. Bay of Bengal populations have showed a separate genetic structure i.e a unique habitat has been existed near St. Martins Island.

149. Sub-project title: Potentials of modernization in fisheries sector of Bangladesh: Study on the peoples' profile, technologies and policies (ID-648)

The sub-project is being executed by the Sylhet Agricultural University (SAU), Sylhet at Bagerhat, Bhola, Chandpur, Chittagong, Comilla, Cox's Bazar, Dhaka, Gazipur, Jessore, Jhenaidah, Khulna, Kurigram, Munshigonj, Mymensingh, Noakhali, Patuakhali, Rangamati, Sirajgonj, Sunamgonj and Sylhet for the duration of July 2017 to September 2018 with the objectives of i) To unfold the technological change and modernization which have taken place in the fisheries sector, ii) To assess how far technological changes and modernization affected the socio-economic condition of the fisher folk as well as the sustainability of the fishery resources and iii) To assist stakeholders (government, private sector, and civil society) in designing and implementing specific policy-oriented activities to shift towards more sustainable fish production through modernization the sector. For pond farming, cooperative farming of multiple ownership pond, access to new and available technologies, soft loan facilities, training and extension services are required. For shrimp industry, practice of semi intensive farming, ensure SPF, improved hatchery, training, awareness and maintenance of bio-security and management are important. For lake fishery, overfishing, illegal gear fishing, pollution by agriculture practice should be controlled through implementing fish act and awareness and ecosystem based management. Jalmahal Policy is required for maintenance of baor fisheries productivity. Establishment of Marine Protected Areas in the coastal critical habitat and migration routes. Strict regulation and strengthening quarantine system are required for importing and use of aqua drugs and chemicals. Indiscriminate use of pesticides should be prohibited to prevent from aquatic environmental degradation in floodplain. GAP rules and regulation should be practiced in fish drying practices.

150. Sub-project title: Production and productivity improvement of haor floodplain fisheries for upliftment of fishers' livelihood (ID-674)

Sylhet Agricultural University (SAU), Sylhet has been executing the sub-project at the flood plains of Sylhet, Moulvibazar and Sunamgonj for the period of April 2017 to September 2018 with objectives of i) To improve the fish yield in *haor* floodplain through community based management, ii) To assess the biodiversity of stocked and non-stocked fish species, iii) To uplift the livelihood of community people in *haor* area.The production performance of monosex tilapia (*Oreochromis niloticus*) under cage culture has been found to satisfactory level in *haor* floodplain.The fish yield has been recorded 160.31-164.50 kg cage^{-1} for 3 months culture period in 27 m^3 size cage. The stocked fish production of pen culture has been recorded 1953.90 kg ha^{-1} 135days^{-1} where non-stocked small fish production has been recorded 446 kg ha^{-1}. The number of non-stocked fish species has been increased 25% over the initial baseline population under sanctuary establishment in *haor* floodplain. After technological intervention, the fish yield of selected *haor* floodplain has been recorded 461 kg ha-^{1} yr^{-1} from the baseline production of 256 kg ha-^{1} yr^{-1}. The overall fish production in *haor* floodplain has been increased against the baseline production with subsequent improvement for employment of fishers, income and household fish consumption.

151. Sub-project title: Study of the climate change impact on fisheries resources and fishers' especially women and children in selected climate hotspot zone of Bangladesh (ID-718)

The sub-project is being implemented by the Bangladesh Agricultural University (BAU), Mymensingh at Sundarbans impact zone, Meghna estuary, high saline zone of Cox's Bazar, Haor basin of

Diversity of fish species at the coastal zones

Kishoregonj and Charland of Munshigonj for the period of April 2017 to September 2018 with the objectives of i) To determine the changes in livelihood (education, health, nutrition, water sanitation, children and women protection and migration) of fishers' particularly women and children in selected climate hotspot zone, ii) To determine the change in availability of fish species through survey, as well as the primary productivity and water quality parameters of climate hotspot zone and non-affected areas and iii) Histopathological analysis of gonad, liver,gills, muscles and kidney of the fishes of climate hotspot zone with those of non-affected ones and evaluation of eggs and sperm quality. Climate change has the negative impact on fishers and fisheries resources in Bangladesh. Physico- chemical parameters (temperatures, dissolved oxygen, pH and salinity) has been changed due to climate change. Shape of fish organs have been found to remain in normal. Gonadal maturation cycle has been changed due to climate change.

152. Sub-project title: Fine tuning of short cycle culture of shrimp Penaeus monodon in rotation with tilapia in the coastal ghers (ID-778)

Bangladesh Fisheries Research Institute (BFRI), Mymensingh has been implementing the sub-project at Paikgacha upazilla of Khulna and Brackish Water Station of BFRI, Paikgacha, Khulna for the period of April 2017 to September 2018 with the objectives: of i) To increase the productivity of coastal *ghers* through year round aquaculture and ii) To demonstrate short cycle shrimp culture system in rotation with tilapia in the farmers' *gher*. In short cycle (60 days), production of shrimp have been obtained 734-797 kg/ha and 705-724 kg/ha in on-station and on- farm respectively. Average body weight of shrimp has been found 17.3-18.2 g and 17.2-17.7 g in on -station and on- farm respectively. Highest average yield in 90 days culture of tilapia has been obtained in on-station pond-4755 kg/ha with a net benefit of BDT 65026.00/ha and BCR was 1.16. Highest average yield in 120 days culture of tilapia has been obtained in on-station pond, 5997 kg/ha with a net benefit of BDT 107218.00/ha and BCR was 1.22.

153. Sub-project title: Improvement of live feed culture for Brackish water hatchery operation (ID-779)

The sub-project is being implemented by Bangladesh Fisheries Research Institute (BFRI), Mymensingh at Brackish Water Station, Paikgacha, Khulna and Marine Fisheries & Technology Station at Cox's Bazar of BFRI for the period of May 2017 to September 2018 with the objectives of i) To up-scale the production of different microalgae (*Nannochloropsis* sp., *Nannochlorum* and *Tetraselmis* sp.) for brackishwater and marine hatchery operations, ii) To enhances the production of rotifers (*Brachionus* sp.) for improvement of larval rearing of fish and crustacean species and iii) To observe the nutritive values (proximate contents and fatty acids) of microalgae and rotifers grown under different protocols. In indoor condition in 2 liter conical flask the highest average density has been observed 6.91×10^6 for *Tetraselmis* sp. while in 60 liter white container in indoor condition highest average density 3.31×10^6 has been observed for *Nannochloropsis* sp. In outdoor condition in 300 liter culture tank the highest average density 3.11×10^6 has been observed for *Nannochlorum* sp. while in 300 liter plastic tank in 20/ml inoculum density with different media the highest average density of rotifer (*Brachionus plicatilis*) 189 ind/ml has been observed for yeast+microalgae. In 300 liter plastic tank in 300-400/ml inoculum density with different media in outdoor condition the highest average density of rotifer (*Brachionus plicatilis*) 721 ind/ml has been observed for microalgae+ fish oil media and no rotifer has been found in fish oil media.

154. Sub-project title: Biochemical and molecular assay for detection of Vibrio spp at shrimp and shrimp farms in Bangladesh (ID-817)

National Institute of Biotechnology (NIB), Savar, Dhaka has been executing the sub-project at its Fisheries Biotechnology Laboratory for the period of May 2017 to September 2018 with the objectives of i) To identify and characterize *Vibrio spp* of shrimp in respective areas of Bangladesh, ii) To develop an effective molecular diagnostic tool against the *Vibrio species and* iii) To select effective antibiotic against vibriosis. 509 samples of shrimp, water, and sediment have been collected from shrimp farms for microbiological analysis of *Vibrio* species. Multiplex PCR method has been adopted to detect five major *Vibrio* species. Antibiotic susceptibility of 150 *Vibrio* species has been isolated from shrimp farms.

155. Sub-project title: Residual assessment of hazardous pesticides and antibiotics in shrimp/prawn farming systems of south-west Bangladesh with its traceability identification and risk quantification on human health (ID-823)

The sub-project is being implemented by Bangladesh Fisheries Research Institute (BFRI), Mymensingh at its Shrimp Research Station, Bagerhat for the duration of July 2017 to September 2018 with the objectives of i) To scrutinize the available pesticides, antibiotics and other aqua-chemicals from existing shrimp/prawn farms of Khulna, Bagerhat and Shatkhira region for knowing its present extent through baseline survey, ii) To determine the residual concentration of hazardous pesticides and antibiotics in shrimp/prawn body and its probable source identification and iii) To assess the impacts of pesticides and antibiotics residues on human health through its risk quantification. A total number of 492 retail shops from the local markets of the three districts (Khulna, Satkhira, and Bagerhat) have been surveyed and 153 different brands of pesticides and 33 different brands of aqua drugs have been found. A total of 108 samples of shrimp, water, sediment have been collected from 36 farms of the districts of Khulna, Satkhira and Bagerhat. Samples from 36 farms have been analyzed for hazardous antibiotics / chemicals and pesticide residues.No hazardous Nitrofuran metabolites and chloramphenicol has been found in the samples. Shrimp samples from 12 farms have been sent to FIQC, Dhaka Lab. to test the presence of Nitro-furan metabolites and chloramphenicol but no hazardous Nitrofuran and chloramphenicol have been found. Shrimp samples from 12 farms have been sent to BARI Pesticide Lab. to test the presence of pesticides but no pesticide residues have been found. Some pesticides residues have been detected in the two samples of Bagerhat district that have been much lower than the acceptable limit.

156. Sub-project title: Adoption of culture technologies of short cycle fish species in the semi-arid zone of Bangladesh (ID-825)

The sub-project is being implemented by Bangladesh Fisheries Research Institute (BFRI), Mymensingh at Nilphamari, Rangpur and Dinajpur for the duration of April 2017 to September 2018 with the objectives of i) To adopt the culture technologies of short cycle fish species and ii) To disseminate the culture technologies in different part of semi-arid zone of Bangladesh. Polyculture of tengra (*Mystus vittatus*) and shing (*Heteropneustes fossilis*) in seasonal waters at the semi-arid zone has been found economically viable. Considering growth and survival, tengra and shing @ 500 nos dec^{-1} has been observed suitable stocking density in polyculture system. Tengra polyculture has been found a bit better than the shing polyculture on the basis of economic aspects. Shing polyculture has been found higher than the tengra polyculture on the basis of production.

157. Sub-project title: Development of mixed culture technology of high valued galda (Macrobrachium rosenbergii) with two native catfish, shing (Heteropneustes fossil is) and magur (Clarias batrachus) in south-western coastal ghers of Bangladesh (ID-827)

Bangladesh Fisheries Research Institute (BFRI), Mymensingh has been executing the sub-project at its Shrimp Research Station, Bagerhat for the period of April 2017 to September 2018 with the objective of i) To adopt the mixed culture technique of prawn *(M. rosenbergii*) and catfish (*H. fossilis*

Production of galda at the coastal ghers

and C. batrachus,), ii) To determine the production performance and survival rate of mixed culture practice, iii) To assess the water quality parameters of gher ecosystem and iv) To investigate the economic potentiality of these culture practices. Highest growth performance of shingh (47.0 g), magur (112.0g) and galda (77.0g) have been obtained from 400, 50 and 30 stocking density/decimal of shing, magur & galda respectively after 06 months culture. Highest survival rate have been exhibited for magur (39.0%) followed by galda (30.0%) and shing (20 %). Highest growth performance of magur (33.0g), shing (22.0 g) and galda (28.0g) have been obtained from shing, magur & galda after 5 months culture.

158. Sub-project title: Production enhancement of carps and tilapia in creeks of Chittagong hill districts (ID-833)

The sub-project is being implemented by Bangladesh Fisheries Research Institute (BFRI), Mymensingh at Rangamati and Khagrachari for the duration of April 2017 to September 2018 with the objectives of i) To popularize fish production technology in the creeks of Chittagong hill districts, ii)

Production of carps and tilapia at creeks in CHT

To increase fish production in the Chittagong hill districts area and iii) To provide alternative livelihood to the fishers during fishing ban in Kaptai Lake. Fish production technology in the creeks has been adopted by the people of Chittagong hill districts. Targeted beneficiaries have been involved with fish culture as their alternative means of income. Growth and production performance of carps and tilapia have been found good. Alternate livelihood opportunity has been created due to fish culture in the fishing ban period in Kaptai Lake.

NUTRITION

159. Sub-project title: The nutritional analysis and popularization of minor fruits to rural and urban communities of Bangladesh (ID-328)

Bangladesh Agricultural Research Institute (BARI), Gazipur has been implementing the sub-project at Gazipur and Moulvibazar for the period of April 2017 to September 2018 with the objectives of i) To determine the vitamins, macro and micro nutrient of minor fruits, ii) To document the bioactive compounds as well as phytochemicals of minor fruits and iii) To promote the nutritional health of the rural and urban people through raising awareness on the nutritive value of minor fruits in dietary diversity. Macro and micro nutrients of 7 selected minor fruits (Chalta –Indian dilenia, Amra- Golden

apple, Amloki - Aonla, Bilimbi, Satkora, Jara Lebu, Deo-phal–Egg tree) have been documented. Antioxidant and phytochemicals namely total polyphenols, phenolic compounds (gallic acid, ferrulic acid, caffeic acid,courmaric acid and vanilic acid),total antioxidant capacity, reducing power capacity, DPPH free radical scavenging activity,ferrous iron chelating activity, carotenoid, anthocyanin and lycopene of 7 selected minor fruits have been documented.

160. Sub-project title: Study on the nutritional quality of underutilized mulberry fruits, leaves & silkworm pupae and their value addition (ID-520)

The sub-project is being conducted by the Bangladesh Sericulture Research and Training Institute (BSRTI), Rajshahi at Rajshahi for the period of April 2017 to September 2018 with the objectives of i) To prepare jam, jelly, sauce etc. from mulberry fruits, ii) To prepare mulberry tea from mulberry leaves and iii) To extract pupae boil from silkworm pupae and study on it's fatty acid profile. Mulberry tea (Cha) from mulberry leaves has been prepared. Mulberry Sauce from mulberry fruits has been prepared. Mulberry jelly from mulberry fruits has been prepared. Pupae Oil has been extracted from silkworm pupae. Fatty acid profile of pupae oil has been analyzed. Nutritional quality of mulberry leaves (% of moisture-66.60%, crude protein -16.37%,crude fibre-10.93%, reducing sugar-2.09%, total sugar-3.72%& starch-13.38%) and silkworm pupae (% of moisture, crude protein, oil & ash) have been assessed.

161. Sub-project title: Vertical farming: The future solutions for organic vegetables production in urban area (ID-521)

Sylhet Agricultural University (SAU), Sylhet has been implementing the sub-project at Sylhet for the period of April 2017 to September 2018 with the objectives of i) Increase the availability of organic and chemical pesticide free vegetables all the year round, ii) To ensure the nutrition security by consuming the fresh organic vegetables, iii) Using the vertical space for vegetable production in urban areas, iv) Find out the suitable vegetables and soil media for the vertical agriculture, v) To increase the land use efficiency and vi) To improve the organic farming industry. Among the five winter vegetables, Lettuce, Red amaranth, French bean and Pak-choi (Bati-shak) have showed good performance in vertical frame cultivation. Spinach has not showed good results. All the vegetables in vertical frame cultivation have showed better results when soil mixed with vermi-compost. In summer, vertical frame cultivation of Indian mint, Water spinach, Indian spinach and Thankuni have showed good performance in the soil mixed with vermi-compost.

162. Sub-project title: Development of commercially feasible pro-biotic food products for human and feed products for poultry using native isolates through biotechnological interventions (ID-532)

University of Khulna (KU), Khulna has been implementing the sub-project at Khulna for the period of April 2017 to September 2018 with the objectives of i) To isolate, characterize and properties studies of native probiotic isolates and ii) To study the effects of native probiotic isolates on mice and poultry through in vivo trails. Forty two native pro-biotic isolates (Presumptive Lactobacillus spp.) have been obtained from yogurt samples. All the isolated probiotics have been found gram positive, catalase negative, non-motile, coagulase positive and have showed

Native probiotic isolates injected in diabatic rats in lab.

significant tolerance against low pH(3.0), bile salt (0.3%), NaCl (1-6%) and phenol (0.1-0.4%) and positive sugar fermentation patterns. Probiotics have showed significant positive results on diarrhea, hypercholesterolemia, immunoglobulin E (IgE) and E. coli in induced mice as well as have improved the glycemic and lipidemic status in type-2 diabetic rats. Buffalo milk yogurt has showed antibacterial activity against seven human enteric pathogens and two enteric fungi.

163. Sub-project title: Qualitative assessment of bottled drinking water and evaluation of pesticides residue of raw, washed and cooked vegetables (ID-638)

Bangladesh Agricultural Research Council (BARC), Farmgate, Dhaka has been executing the sub-project all over the country for the period of April 2017 to September 2018 with the objectives of i) Evaluation of microbial, chemical and biochemical assessment of different types of bottled/jar drinking water in Bangladesh market *(component-1)*, ii) To determine the residue level of pesticide at market, washed and cooked samples of major indigenous vegetables *(component -2)and* iii) Development of communicable materials for wide awareness building for pesticide and healthy water for public health *(component 1 & 2)*. Around 96 % of marketed jar water have been found contaminated with coliform while branded bottled water have been found germ free. The total colifirm and faecal coliform have been recorded between 17-1600 MPN/100ml and 11-240 MPN/100ml respectively.Most of the marketed jar drinking water has not been authorized by BSTI/WASA. Residue levels of different vegetables at raw, washed and cooked samples have been recorded 62.5%, 37.5% and 18.75% respectively. About 70-85% of pesticides residue has been removed while washing vegetables before cooking. 12.5% of raw and 6.25% of the washed samples of vegetables have been found with pesticides residue above MRL. Residue of pesticides namely Cypermethrin, Chlorpyrifos, Carbendizam and Dimethioate have been found remained even after cooking in few samples, but all of these residue levels have been found below MRL. Pesticides residue of vegetables have been either removed fully and/or reduced below MRL when cooked at 100^0C or above temperature.

View of vegitables for residue analysis

164. Sub-project title: Production of low cholesterol healthy mutton by using natural herbs (ID-719)

Bangladesh Agricultural University (BAU), Mymensingh has been implementing the sub-project at Mymensingh for the period of June 2017 to September 2018 with the objectives of i) To efficacy test of medicinal herbs on mutton cholesterol and ii) To identify the antioxidant level of mutton. Herbal supplementation (Plantain, garlic leaves etc.) has been boosted up the growth performance of native

sheep. Feeding TMR diet (Road side grass, rice straw, wheat bran, mustard oil cake, molasses and common salt based) with herbal supplementation has been boosted up serum antioxidant status in native sheep. Herbal supplementation has been found to reduce blood and mutton cholesterol content.

LIVESTOCK

165. Sub-project title: Dietary effect of hydro-phonic legume sprouted fodder on Turkey production in Bangladesh (ID-309)

Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur has been implementing the sub-project at the Turkey Research Unit, Faculty of Veterinary and Animal Science of HSTU for the duration of July 2017 to September 2018 with the objectives of i) To investigate the effect of dietary supplementation of hydroponic sprouted fodder on productive and reproductive performances of turkey, (ii) To know the quality and nutrient characteristics of turkey meat and (iii) To study the economic sustainability of hydroponic sprouted fodder on turkey production in Bangladesh. Nutrient composition of hydro-phonic sprouts of maize, sesbania and wheat has been determined. Optimum level of dietary hydro-phonic sprouts (15%) has been identified for better growth performance. Hydro-phonic sprouts (up to 15%) may be used for economic production of growing turkey. Seven rations have been formulated (0-4, 4-8, 8-12, 12-16, 16-20, 20-24 weeks old and breeding hen) for the heritage type of turkeys available in Bangladesh.

166. Sub-project Title: Development of estrus synchronization protocols using hormones in anestrus cows for improved reproductive performance (ID-313)

The sub-project is being implemented by the University of Rajshahi (RU), Rajshahi at the private and Govt. dairy farms of Rajshshi for the duration of July 2017 to September 2018 with the objectives of i) Observation of the prevalence of anestus in relation to different risk factors in heifer and postpartum cows, ii) Development of effective estrus synchronization protocols using hormones and iii) Evaluation of the effective pregnancy diagnosis technique in cows by using different tools. The prevalence of anestrus cows has been recorded 54.42 % which is alarming for sustainable dairy farming in Bangladesh. The cross breed Sahiwal, <4 years age groups, < 200 kg body weight, poor body condition, 1st parity cows and heifer factors have been found favorable for high percentage of anestrus. The good housing system, medium size farm, good quality feed, sufficient fodder, good health care, allopath medicine, DLS health service, regular preventive measure, regular de-worming, > 5 years farming experience and having training of farmer have showed less change to anestrus in cows. 90 % of anestrus cows have been come to estrus by using PG-GnRH-PG treatment protocol followed by PG-PG and PG-PG-PG fixed time AI (85 %). The ELISA has been found effective pregnancy diagnosis method in dairy cows with minimum cost (285 TK. per cow). Ultrasound method has been found good technique for early pregnancy diagnosis in dairy cows (from 28 days).

167. Sub-project title: Seroprevalence and identification of associated risk factors of Q-fever *(Coxiellaburnetii)* in ruminants an emerging zoonotic disease in Bangladesh (ID-321)

The sub-project is being implemented by the Patuakhali Science and Technology University (PSTU), Patuakhali at the different upazillas of Pabna, Sirajgonj, Jhenaidah and Chuadanga for the duration of April 2017 to September 2018 with the objectives of i) Sero-prevalence of Q-fever in ruminants and farm workers by ELISA in different areas of Bangladesh, ii) Determination of the presence of *Coxiellaburnetii* DNA inseropositive of raw milk from ruminants and sera (both animal and human) and iii) Identification of risk factors for Q-fever in Bangladesh. The overall seropositivity of Q-fever in goats and cattle has been found 11.9 % and 9.5 % respectively. Milk-positivity of Q-fever in goats

and cattle has been found 10.7 % and 8.3 % respectively. The prevalence of tick infestation in male and female cattle has been found 42.6 % and 46.4 % respectively. The prevalence of abortion in tick infested animals has been observed 17.6% and 15.2% in female cattle and goat respectively. The seroprevalence of Q-fever has been found higher in female than male both for cattle and goat.

168. Sub-project title: Identification of the causes of high calf mortality in buffalo and their mitigation measures in Bangladesh (ID-349)

Sylhet Agricultural University (SAU), Sylhet has been conducting the sub-project at different locations of Bangladesh for the period from July 2017 to September 2018 with the objectives of i) Isolation and identification of causative organisms associated with buffalo calf mortality in Bangladesh, ii) Identification of environmental and managemental risk factors associated with calf mortality in buffalos and iii) Development of appropriate therapeutic measures and control strategies against buffalo calf diseases. Bacterial and parasitic causes of buffalo calf mortality in Bangladesh have been identified. Viral causes are being investigated. Environmental and management related risk factors associated with calf mortality in buffalos has been identified. Poster & Leaflet on disease calendar of buffalos along with vaccination schedule has been prepared to disseminate in buffalo farmers and policy makers as a means of mitigation of buffalo calf morality in Bangladesh.

169. Sub-project title: Prevalence and molecular characterization of shiga toxin producing Escherichia coli (STEC) in poultry and their products in Bangladesh (ID-362)

The sub-project is being implemented by the Bangladesh Agricultural University (BAU), Mymensingh at its Department of Microbiology and Hygiene for the duration of April 2017 to September 2018 with the objectives of i) Isolation, identification and serogrouping of *E.coli* field isolates of broiler, layers and indigenous chickens, ii) Molecular characterization of shiga toxin producing genes (*stx1 and stx2* genes) by polymerase chain reaction and sequence analysis of the amplified genes and iii) Determination of antibiotic sensitivity profile of the STEC isolates of broiler, layers and indigenous chickens against commonly used antimicrobial agents. Shiga toxin producing *E.coli* (Stx1 and Stx 2) from broiler, layer and indigenous chicken have been isolated and identified by PCR. Shiga toxin producing *E. coli* such as O157: H7, O111, O26 and O45 has been successfully isolated and identified from the poultry and their products. Suitable antibiotics have been identified against Shiga toxin producing *E. coli (*STEC) infection. Norfloxacin, Azithromycin and Amikacin have showed the highest sensitivity pattern against STEC.

170. Sub-project title: Development of live attenuated duck plague vaccine using local duck plague virus strains (ID-367)

Bangladesh Agricultural University (BAU), Mymensingh has been executing the sub-project at its Department of Microbiology and Hygiene for the duration of July 2017 to September 2018 with the objectives of i) Isolation, identification and characterization of duck plague virus (DPV) from field outbreaks, ii) Development of live attenuated duck plague vaccine from local field strains and iii) Determination of efficacy of the developed vaccine. Ten duck plague viruses (DPV) have been isolated and identified from field outbreaks of duck plague. All DPVs have been adopted into the embryonated duck eggs. Phylogenetic analysis of three DPVs (BAU, DP1, DP2 and DP3) have showed complete similarly with Anatid alpha herpes virus 1 originated from China (KU216226.1) and Anatid alpha herpes virus 1 originated from Bangladesh (KX768734.1).

171. Sub-project title: Genetic improvement of indigenous cattle for beef production through crossing with Brahman cattle by farmers participatory breeding approach in Bangladesh (ID-395)

View of Brahman cattle at BAU

The sub-project is being conducted by the Bangladesh Agricultural University (BAU), Mymensingh at the Mymensingh Sadar and Gouripur upazillas of Mymensingh for the period from April 2017 to September 2018 with the objectives of i) To improve the genetic potentiality of indigenous cattle for beef production by crossing with Brahman inheritance and ii) To evaluate the growth performance and adaptability of Brahman crossbreds to local environment of Bangladesh. A total of 724 Brahman crossbred calves have been born and phenotypic appearance of these calves has been observed very attractive. Calve mortality (3.23%) and dystocia (0.61%) have been found to be negligible. Birth weight, 12-month weight and average daily gain of Brahman crossbred calves have been found higher than the existing cattle genotype of Bangladesh.

172. Sub-project title: Characterization of Mycoplasma gallisepticum isolates from Bangladesh and their use in production of diagnostic antigen and development of vaccine candidate (ID-403)

The sub-project is being implemented by the Sylhet Agricultural University (SAU), Sylhet at the Department of Pathology and Department of Microbiology and Immunology, Faculty of Veterinary and Animal Science of SAU for the period from July 2017 to September 2018 with the objectives of i) Characterization of *Mycoplasma gallisepticum* field isolates and ii) Preparation of diagnostic antigen and development of vaccine candidate from this field strain. Five samples of Mycoplasma gallisepticum (MG) has been collected from Goala bazar, Dokhin surma, Dhaka dokhin, Fenchugonj and Alutol of Sylhet district. Three samples have been found positive in Hayflicks Agar and Freys broth. All the three samples have been found positive with MG Specific primer which may be used for vaccine development to control the poultry disease.

173. Sub-project Title: Molecular characterization of Babesia, Theileria and Anaplasma organism in livestock in Bangladesh (ID-426)

Bangladesh Agricultural University (BAU), Mymensingh has been conducting the sub-project at its Department of Parasitology for the duration of April 2017 to September 2018 with the objectives of i) Establishment of methodologies for detection of *Babesia, Theileria* and *Anaplasma* in Bangladesh and ii) Molecular characterization and genetic analysis of *Babesia, Theileria* and *Anaplasma* spp. in cattle, sheep and goat in Bangladesh. Ninety blood samples of adult cattle have been collected from BAU teaching hospital, Dinajpur sadar, Rowmari upazilla of Kurigram, Sirajgonj, Mymensingh (Dewkhola, Fulbaria) and Rangpur (Kaunia) for characterization of Babesia, Theileria and Anaplasma organisms.

PCR has been performed targeting the 16S rRNA gene of Anaplasma spp and 18S for Babesia and Theileria. Out of 90 samples, 28 positive samples have been observed in both microscopically and PCR which has confirmed the methods of detection.

174. Sub-project title: Development of effective vaccine against Bovine Mastitis (ID-443)

The sub-project is being implemented by the Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur at its Department of Micribiology for the period from June 2017 to September 2018 with the objectives of i) To isolate and identify the microbial agents causing mastitis in cattle and ii) To develop an inactivated vaccine against bovine mastitis. Forty eight samples have been collected and analyzed through cultural and bio-chemical test for isolating and identifying the microbial agents causing mastitis in cattle. All the 48 samples have showed E. coli and Streptococcus spp. positive while 30 and 28 samples have showed Klebsiella spp. and Staphylococcus spp. positive respectively.

175. Sub-project title: Monitoring and surveillance of duck diseases in Hakaluki and Tanguar hoar and development of suitable vaccination models and other preventive strategies (ID-448)

Chittagong Veterinary and Animal Science University (CVASU), Chittagong has been executing the sub-project at Hakaluki and Tanguar haor of Sylhet division for the duration of May 2017 to September 2018 with the objectives of i) To develop a database of existing infectious and non-infectious diseases of ducks in household and commercially raised in selected areas of Hakaluki and Tanguar haor and their risk factors, ii) To monitor the duck diseases through active surveillance and GIS mapping and other epidemiological tools for development of duck disease model and iii) To identify the challenges of duck farming in haor areas and development of strategic plans concerning duck disease and their prevention through vaccination, and anthelmintics therapy. A data base of selected infectious diseases of ducks in household and commercially raised ducks in selected areas of Hakaluki and Tanguar haor and their risk factors has been developed. A benchmark for active surveillance of duck diseases has been established. A GIS map of infectious diseases in haor areas has been developed. A vaccination schedule fit for duck farming in haor areas has been constructed based on the risks identified and experts' opinion through workshop.

176. Sub-project title: Establishment of suitable fracture management techniques in different animals (cattle, goat, dog, cat) (ID-533)

The sub-project is being implemented by the Chittagong Veterinary and Animal Science University (CVASU), Chittagong at Sahidul Alam Quadery Teaching Veterinary Hospital (SAQTVH) in Chittagong with the objectives of i) To study the incidence of long bone fracture in different animals (cattle, goat, dog, cat) and ii) To establish the suitable fracture management technique by evaluating the preoperative and postoperative analysis/outcome of the patients. A total number of 6163 fracture cases of cattle, goat, dog and cat have been occurred. Among them, 13.45% and 10.25% have been found surgical and long bone fracture cases respectively. The highest fracture incidence has been observed in goat (42.35%) followed by dog (23.52%), cat (22.35%) and cattle (11.76%) respectively. The maximum causes of fractures have been observed falling from height (34.11%) followed by trauma by fighting, beating etc. (21.18%), unknown (20%), automobile accident (12.94%) and stuck in cot (11.76%) respectively.

177. Sub-project title: Development and evaluation of formalin killed inactivated egg drop syndrome virus vaccine using local isolates (ID-556)

View of layer birds under experimental condition at BAU

The sub-project is being implemented by the Bangladesh Agricultural University (BAU), Mymensingh at its Department of Micribiology and Hygiene for the duration of April 2017 to September 2018 with the objectives of i) Development of formalin killed oil adjuvanated EDS vaccine and alum adsorbed EDS vaccine, ii) Determination of protective efficacy of experimental vaccine against EDS-76 virus in layer birds under experimental conditions and iii) Application of vaccine at commercial layer farms. The virus has been successfully reactivated in duck embryo. The virus sample @ EID_{50}-$10^{8.6}$ /ml has been successfully inactivated by formalin. No growth of bacteria in bacteriological media and no growth of virus in duck embryo have indicated the virus is sterile, completely inactivated and safe to use as vaccine in chicken. Three different experimental EDS vaccines have been prepared by using three different oil adjuvants, named as BAU-EDS1, BAU-EDS2 and BAU-EDS3. Experimental EDS BAU-EDS3 has been found to induce higher antibody titre and gave higher protection compare to other experimental vaccine like as commercial vaccine Nobilis®. After challenge with virulent field isolate EDS virus in laying hen, BAU-EDS3 has been found to give higher protection (90-95%) compare to other experimental vaccine.

178. Sub-project title: Benchmarking cost of milk production in typical dairy farms in selected regions of Bangladesh: Implications for milk market price and livelihood improvement policy (ID-557)

The sub-project is being executed by the Bangladesh Agricultural University (BAU), Mymensingh at Sirajgonj and Bogura for the period from May 2017 to September 2018 with the objectives of i)To characterize the FMD viral Topotypes (Serotype O, A and Asia 1) from repository/ field outbreaks, (ii) To isolate the FMD viral Topotypes through propagation on BHK cell, iii) To inactivate the FMD viruses by using Binary ethyleneimine (BEI), (iv) To evaluate immune-efficacy of the vaccine (BAU/BARC/Khura) in guinea pig and cattle model and (v) Handed over vaccine seed (BAU/BARC/Khura) to the Department of Livestock Services (DLS), Ministry of Livestock and Fisheries, Bangladesh. Average milk yield (kgECM/cow/year) has been found 1801, the highest (2673 kg) and the lowest (770 kg) yield have been observed for business farms in Sirajgonj and household small farms in Bogura. The average cost of milk production (COMPO) has been found BDT 3239/100 kg ECM while the average for Bogura has been observed higher (BDT3482/100 kg ECM) than Sirajgonj (BDT 2995/100 kg ECM). Looking into total cost of the dairy enterprise, BDT 6096 /100 kg ECM, Sirajgonj has shown the lowest average costs (BDT 5800/100 kg ECM) compared to Bogura (BDT 6393 /100 kg ECM). The differences between COMPO and total costs have been found significantly different which has not been known by the farmers and processors.

179. Sub-project title: Substantial development of genetic potential for improved productivity in cattle through manipulative reproduction technology (ID-603)

Bangladesh Agricultural University (BAU), Mymensingh has been implementing the sub-project at the different upazillas of Dhaka, Munshigonj ,Mymensingh, Sirajgonj, Jamalpur, Bogura, Manikgonj, Kushtia and Chittagonj for the duration of April 2017 to September 2018 with the objectives of i) To examine socio-economical impact of genetic improvement of cattle via conventional Artificial Insemination (AI) program in some selective areas of Bangladesh, ii) To determine the factors affecting the adoption of AI using different bull semen by farmers, iii) To study the factors affecting production of male and female offspring after conventional AI, iv) To study the reproductive efficiency of heifers and cows born after AIs well as productivity and profitability of cattle farms, v) To implement the manipulative reproduction techniques such as semen processing, estrus synchronization and timed artificial insemination (TAI) at the farm level for the production of sex selective offspring to speed up the genetic improvement of economic traits of cattle, vi) To optimize cost effective production of high quality sperm to improve fertility with sex selective offspring and vii) To establish proper synchronization protocol for timed artificial insemination. Farmers' education and breed of bull have been observed to play an important role for the adoption of AI. Sex hormones estrogen and testosterone present at the time of AI might play a major role for sex characterization. Income/cow has been slightly increased after breed up-gradation by AI in cattle. Marked breed variation has been observed in sperm morphometry in breeding bull. 72% male calves and 85% female calves have been obtained from Fraction-1 and Fraction-4 respectively. Head wide larger Fractioned sperms have produced more female calves. Estrus synchronization protocols have been increased pregnancy and calving rates have also been varied markedly at commercial farms.

Lab activities of the sub-project at BAU

180. Sub-project title: Mining nobel probiotics from Red Junglefowl (Gallus gallus) as the alternatives to antibiotics for the safe poultry production (ID-607)

The sub-project is being implemented by the Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur at the Faculty of Veterinary Medicine and Animal Science, BSMRAU for the period from April 2017 to September 2018 with the objectives of i) Isolation of lactic acid bacteria (LAB) from the gastrointestinal (GI) tract of Red Junglefowl (RJF), ii) Screening of the LAB for probiotic potential and (iii) Molecular characterization of the LAB having probiotic potential and searching for bacteriocin producing genes in probiotic strains. A total of three Red Junglefowl(RJF) have been collected from Shonaichhari mouza, Betbunia union of Rangamati district and Baishari union, Naikhongchhari upazila of Bandarban district. The captured RJF have been identified by evaluating their phenotypic characteristics. Thirty nine isolates have been purified from different parts of the gastrointestinal digestive tracts (crop, small intestine, large intestine and cecum) of RJF. Molecular characterization of the 39 pure isolates based on 16S rRNA gene revealed the predominant

isolates have been identified as Lactobacillus reuteri (74.35%) followed by Lactobacillus salivarius (17.9%) and Weissella paramesenteroides (7.69%). The antimicrobial activity of the representative 13 isolates against E. coli and Salmonella sp. (isolated from chicken intestine) has been evaluated by the agar well diffusion assay. Seven of them have showed very good inhibition effect by forming inhibitory zone around the well. Out of 14 representative isolates three and two have been observed highly auto-aggregated and moderately auto-aggregated respectively. The surface hydrophobicity of these isolates has also showed good ability to bind hydrocarbon. Five isolates have showed ability to survive in 0.3% bile solution. None of the isolate could not to grow in highly acidic condition (pH 2.5). However, in other pH (ranges from 5.0 to 7.5) they could grow well.

181. Sub-project title: Floating bed fodder cultivation in submerged and flooded areas in Sylhet district: A tool for climate resilient livestock production (ID-647)

The sub-project is being implemented by the Sylhet Agricultural University (SAU), Sylhet at the submerged and flooded areas of Sylhet for the duration of July 2017 to September 2018 with the objectives of i)To accustom farmers in cultivating floating bed fodder in lean period in low cost, ii) To ensure year round plan for feed the animal and iii) To uplift the production status of cattle and improve the socio-economic condition of small holders near haor area. Production of green fodder (German grass) in floating bed has been found similar or some cases superior compare to land and growth of fodder has been observed higher in rainy season than winter. In vitro degradiability of fodders produced in rainy season have been found higher compare to fodders produced in winter. Fodder quality has been observed a positive correlation (r =.746) with dissolved oxygen of water. Production of German grass has been found higher than dal. In vitro degradiability of silage has been observed higher than fresh fodder. Floating bed may be used as alternative of land for fodder production in flood prone or haor area.

Cultivation of fodder on floating bed

182. Sub-project title: Small scale farming of guineafowls and turkeys in Bangladesh- a tool for poverty reduction (ID-654)

The sub-project is being implemented by the Bangladesh Agricultural University (BAU), Mymensingh at Rajshahi, Naogaon and Central Laboratory of BAU, Mymensingh for the period from April 2017 to September 2018 with the objectives of i) To observe the meat and egg production performances of guineafowls and turkeys in complete confinement rearing system, ii) To observe the growth performance of guineafowls and turkeys

View of turkey farming at BAU

under small scale farming in semi-scavenging system and iii) To analyze the economic feasibility of small scale guineafowl and turkey rearing for poverty reduction. Both guinea fowl and turkey have been found to rear successfully as part of poultry production under small and medium scale farming. As a new species of poultry in Bangladesh, turkey has well adapted with local environment. However, production of quality poults has been observed the major challenge. Small and medium scale rearing of guinea fowl and turkey has been observed profitable with some specific interventions.

183. Sub-project title: Assessment of the impact of climate change on arthropod vectors those transmitting vector borne diseases in Bangladesh (ID-659)

Bangladesh Agricultural University (BAU), Mymensingh has been executing the sub-project at throughout the country for the duration of July 2017 to September 2018 with the objectives of i) To recognize the change of climate variables in Bangladesh by meteorological data, ii) To identify the arthropod vectors and to determine their distribution in Bangladesh and iii) To assess the relationship between climate change and vectors in Bangladesh. A total of 4789 ticks, 2096 lice, 936 flies, 17 fleas and 10997 mosquitoes have been collected from seven topographic zones of Bangladesh. Five (5) species of ticks, 4 species of lice, 4 species of flies, 1 species of fleas and 13 species of mosquitoes have been identified. Dominant species of arthropods in Bangladesh have been confirmed by PCR. Seasonal prevalence of arthropods has been determined. Number of arthropods has been correlated with meteorological data.

184. Sub-project title: Development of low-cost technology for making processed cheese (ID-661)

The sub-project is being implemented by the Bangladesh Agricultural University (BAU), Mymensingh at Dhaka & Chittagong divisions and at the Department of Dairy Science, BAU, Mymensingh for the period from July 2017 to September 2018 with the objectives of i) Development of a cost-effective technology for making processed cheese to get a better value added dairy product Patentable technology of a processed cheese for the industry, ii) Specification of appropriate parameters - raw materials, composition, physical properties, organoleptic attributes, microbial standards, shelf-life, labeling, etc. - of processed cheese for the market of Bangladesh-Standard for locally made processed cheese and iii) Popularization of processed cheese and its manufacturing making technology among consumers and manufacturers- Spread of information on processed cheese and cheese making technology through leaflets. Compositional analysis of 103 batches of processed cheese has been done with 40% average moisture and 50% fat in solids. The percentage of microbial rennet has been standardized to be 0.05 g per liter of milk. Organoleptic evaluation revealed that the treatment T2BX (25% Short + 50% Medium + 25% Long + 3% ES + 2% salt) produced cheese has better flavor, body & consistency, and color & appearance. The treatment T3CX (25% Short + 25% Medium + 50% Long + 4% ES + 2% salt) has been found to be the most cost effective (Tk 535/kg).

A Partial view of processing of cheese

185. Sub-project title: Assessment of effectiveness of avian influenza vaccination in commercial layer birds in Bangladesh (ID-694)

The sub-project is being implemented by the Bangladesh Agricultural Universit (BAU), Mymensingh at the Department of Medicine, BAU, NRL-AI and Animal Health Research Division of BLRI for the duration of April 2017 to September 2018 with the objectives of i) To measure the antibody titre against AI in commercial layer birds, ii) To differentiate infected from vaccinated birds in terms of immune response through ELISA-based DIVA strategy and iii) To assess the immune escaped AI virus (AIV) shedding in AI vaccinated flocks. None of the two AI vaccines, Re-6 and HVT-AIV produced consistent protective antibody and conferred flock immunity. Percent of birds with protective humoral Ab titre against AIV type A has been found higher in Re-6 vaccinated birds in Gazipur. HVT-AIV vaccine has been failed to produce protective humoral Ab titre against AIV type A- cellular immunity. Positive H9 has been found in 21% vaccinated birds.

186. Sub-project title: A field study on survivability of vitrified embryos in Bangladeshi native sheep (ID-722)

Bangladesh Agricultural University (BAU), Mymensingh has been implementing the sub-project at its Department of Surgery and Obstertrics and selected sheep farms in Mymensingh with the objectives of i) To study the survivability of transferred vitrified embryo in farmers field and ii) To create awareness on sheep farm management and application of assisted reproductive technologies in sheep farms. Multiple Ovulation and Embryo Transfer (MOET) in indigenous sheep has been established. Development of embryo vitrification protocol has been optimized. Direct transfer protocol of vitrified embryos in the field recipient ewes has been developed. The pregnancy rate has been found 58% in the field ewe recipients following direct transfer. The born of lamb by direct transfer of vitrified embryos in the field recipient ewes (66.6%) has been recorded first time in Bangladesh.

View of native sheeps at BAU

187. Sub-project title: Assessment of methane emission in dairy production systems based on existing feed resources through GLEAM model under different climatic zones of Bangladesh and their mitigation options (ID-781)

The sub-project is being implemented by the Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka at the experimental field of BLRI HQ, Savar and different agro-clmatic zones of Banladesh, namely coastal, saline, flood plain, drought and ganges flood prone areas of Bhola, Satkhira, Pabna, Chapainawabgonj and Kurigram, respectively for the duration of April 2017 to September 2018 with the objectives of i) To assess the existing feed resources based dairy (cattle & buffaloes) production feeding systems in different regions of Bangladesh, ii) To calculate the enteric methane emission from dairy animal based on existing feeding practices available in different regions of Bangladesh through GLEAM model and iii) To develop existing feed resources based suitable feeding practices/ methods and to demonstrate selected feeding interventions to mitigate enteric emission and environmental pollution from dairy animals under different regions of Bangladesh. Actual amount of enteric methane emitted from dairy animal in different climatic zones of Bangladesh has been estimated through GLEAM model. The suitable fodder which emits low quantity of methane has been identified.

188. Sub-project title: Development of cost effective complete pelleted feed and its utilization for commercial goat and sheep production (ID-788)

View of complete pellete feeding system

Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka has been implementing the sub-project at BLRI HQ, Dhaka and at the farmers field of Mymensingh and Noakhali with the objectives of i) To develop cost effective commercial goat and sheep pellet using crop residues and locally available agro-industrial by products and ii) On station and on farm testing of developed pelleted feed and economic impact analysis. A cost effective complete pellet feed has been developed by using rice straw as roughage and some other agro industrial by-products are as concentrate source for commercial goat and sheep production. The body weight gain has been increased and FCR and feed cost has been reduced considerably by pellet feeding. No clinical symptoms and other health hazards have been observed due to complete pellet feeding. Developed complete pellet could be an alternative ready feed for commercial goat and sheep production under stall feeding condition.

189. Sub-project title: Development of pro- biotic feed supplement for calves (ID-790)

The sub-project is being conducted by the Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka at its Biotechnology Laboratory (Feed BiotechnologyI for the period from November 2017 to September 2018 with the objectives of i) To develop a feed supplement for calves containing a mixture of different probiotic microbes preferably of *Lactobacillus, Bacillus* and *Sacharomyces* species and ii) To study the effects of developed feed supplement on growth performance and health of calves. Four pro-biotic feed supplements have been formulated as potential to be used for calves. Pro-biotic feed supplements based on rice polish and wheat bran may be recommended considering their quality and shelf life. Wheat bran based pro-biotic feed upon feeding to milk-fed calves from 15-90 days after birth has been resulted improved fecal characteristics, lesser E. coli load, but higher pro-biotic microbes have shown shedding in feces, lower diarrheal incidence and improved metabolic profile.

190. Sub-project title: DNA bar-coding of common native livestock & poultry and crossbreed animals in Bangladesh: Potential uses in conservation for increasing production (ID-820)

National Institute of Biotechnology (NIB), Savar, Dhaka has been implementing the sub-project at its Animal Biotechnology Laboratory for the period from April 2017 to September 2018 with the objectives of i) To construct a DNA barcoding database for common livestock and poultry available in Bangladesh for providing the molecular basis to support decisions and set priorities for the conservation of local livestock and poultry genetic resources, (ii) To clarify genetic relationships and breeding history of domestic breeds, crossbreeds (hybrids), and their wild relatives and (iii) To determine breed traceability within some species (e.g., buffaloes, goats, sheep, chickens, and ducks) that will aid in patenting our genetic resources. A total 985 biological specimens of cattle, sheep, goat, buffalo, chicken, duck and pigeon have been collected from different region of the of the country. DNA extraction and PCR amplification have been completed. Sequencing for DNA bar-coding has been completed. Draft DNA barcode has been prepared.

3.4: Program Based Research Grant (PBRG) Sub-projects

The second window of NATP-2 research investment is institutional Program Based Research Grant (PBRG) including research on cross cutting issues. National Agricultural Research Institutes (NARIs) has made considerable success in technology generation but could do much more if enough financial supports provided to strategic inter-disciplinary research on particular facets of demand led areas. To this context, the designed institutional PBRG of NARIs is conducive and effective approach. PBRG targeted to make stronger footing with team building holistic research culture for achieving desired output for commodities and production practices. Most importantly, coordinated PBRG program amongst NARIs made wider scopes in integrating multiple organizations for jointly combating national agricultural problems and strengthening their research and research management capability apart from effective and proper resource uses in national perspectives.

PBRG programs are being coordinated involving at least two research providers: Coordination can be inter-institutional or it can be interdisciplinary within the institute. In case of inter-institutional coordinated program, either BARC or one of the participatory organization coordinate the research programs. NARIs, Public University, Private Research Providers and International Research Centers with co-financing arrangement is considered for PBRG program. NARIs gets priority for implementation of PBRG programs. Non-NARI research providers must have adequate technical manpower and physical facilities for conducting the proposed research. International Research Centers under co-financing arrangement can participate in PBRG program in collaboration with national organizations. Under NATP-2, 33 PBRG research sub-projects planned to be undertaken for technology generation, and PBRG research proposal may get up to USD 500000 (about BDT 387.5 lakh) depending on the size, nature and importance of the proposal.

The duration of the PBRG sub-project is maximum a period of 4 (Four) years or less i.e up to June 2021. It must complete the field/ lab research activities within December 2020 of the implementing component and provide draft Project Completion Report (PCR) along with necessary data and information to the Coordination Component within February 2021. The Coordination Component must submit the final PCR to the PIU-BARC, NATP-2 within June 2021. It may be mentioned here that all the activities of PBRG sub-project to be completed no later than one year prior to NATP-2 closing date in order to allow enough time to adequately disseminate the research results.

According to operational guideline of AIF-1, PIU-BARC had advertised invitation of Concept Note (CN) for PBRG sub-projects on 03 October, 2016 (First Call). After deadline, PIU-BARC received 148 CN of PBRG research proposals .Nine Technical committees of different Technical Divisions of BARC had reviewed the 148 CN of PBRG research proposals and selected 48 CN for submission of full research proposals. Technical Divisions of BARC had prepared independent reviewers panel. According to Project Implementation Manual (PIM), submitted each Full Research Proposal (FRP) was reviewed by two independent reviewers. After rigorous review, Executive Council (EC) of BARC had approved until now 39 PBRG sub-projects with BDT 102.38 crore against the targeted 33 PBRG sub-projects. Out of 39 approved PBRG sub-projects, 38 PBRG sub-projects have already been awarded and signing of Letter of Agreement (LoA) of 36 projects has already been completed. A lump sum amount of fund (BDT 5.50 crore) has been disbursed to 26 PBRG sub-projects for initiating the research activities. The list of awarded PBRG sub-projects with name of coordinator and Principal Investigator & budget is shown in **Annex- II.**

Table-3: Institute Wise Coordinator of Approved PBRG Sub-projects

SL. No.	Name of Institute/ Organization	PBRG Sub-projects	Implementing Organization
1.	BARC	26	BARC, BARI, BRRI, BINA, BFRI (Fisheries), BSRI, BFRI (Forest), BJRI, BLRI, CDB, BSRTI, SRDI, BTRI, BAU, BSMRAU, SAU (Dak), SAU (Syl), CVASU, PSTU, HSTU, SUST(Syl), DU, KU, RU,CU (Ctg), NSTU, SSURDA : 27
2.	BARI	05	
3.	BRRI	05	
4.	BFRI (Fisheries)	02	
5	BINA	01	
Total		39	

Table-4: Division/ Discipline Wise Status of Approved PBRG Sub-projects

Sl. No.	Division/Discipline	No. of PBRG approved by EC	LoA Signed	Under process
1	Crops	10	10	-
2	Fisheries	06	06	-
3	Livestock	05	04	01
4	AERS	02	02	-
5	Planning & Evaluation	03	03	-
6	Soil	02	02	-
7	Forest	04	03	01
8	Agrl. Engg.	03	03	-
9	Nutrition	04	03	01
Total		**39**	**36**	**03**

Chapter 4

Monitoring and Evaluation

Monitoring and Evaluation (M &E) are the essential functions in goal achieving activities of CRG and PBRG sub-projects. It is necessary to monitor the sub-project activities periodically to determine whether the activities proceed as planned or not. The following monitoring cell/teams have been formed for monitoring the implementation progress of the awarded sub-projects.

4.1: Formation of Monitoring Cell/ Team

Central M & E Cell at BARC: Central M & E Cell has been formed by the BARC for monitoring the implementation progress of CRG & PBRG sub-projects. Central M & E Cell of BARC is responsible for designing, organizing and managing the activities of M & E of PBRG sub-projects as well as to undertake necessary measures to any of the sub-projects, Coordinators/ PIs who will fail to reach the milestones/ indicators mentioned in the project proposals.

Division wise M & E Cell at BARC: Division wise M & E Cell has been formed by the Technical Divisions of BARC for monitoring the implementation progress of CRG sub-projects.

PIU-BARC Monitoring Team: PIU-BARC, NATP-2 has formed Monitoring Teams for monitoring the implementation progress of CRG sub-projects.

Institutional M & E Cell: Most of the recipient institutes have already formed their institutional monitoring team as well as Focal Point has also been nominated for monitoring the implementation progress of CRG & PBRG sub-projects. Rest of the recipient organizations have to form the same as soon as possible. Monitoring team of recipient institute is responsible to feedback the report to PIU- BARC including respective Coordinators/ PIs of the sub-projects to undertake necessary measures. Coordinators/ PIs of sub-projects there after shall send the reports including undertaken measures to PIU-BARC.

4.2: Desk & Field Monitoring

BARC and recipient organizations are responsible for conducting desk and field monitoring by following desk and field monitoring format. PIU-BARC has already developed Desk & Field Monitoring Format for monitoring the implementation progress of CRG & PBRG sub-projects.

Desk Monitoring: Desk Monitoring are being conducted through evaluating quarterly, half yearly and annual progress reports, SoE, progress review workshop, telephonic discussion, etc.

Progress Review Workshop: Eight progress review workshops on the implementation progress of CRG sub-projects have been organized by the respective Technical Division of BARC and PIU-BARC under the guidance of PIU-BARC, NATP-2.

A partial view of progress review workshop under Livestock Division

Field Monitoring: Field monitoring are being conducted by the monitoring team of the Technical Divisions of BARC and PIU-BARC, NATP-2 as well as by the internal monitoring team formed by the respective recipient institutes through prescribed format. Out of 190 CRG sub-projects, 152 sub-projects have already been monitored by the monitoring teams of the Technical Divisions of BARC and PIU-BARC through prescribed format.Monitoring reports revealed that the implementation progress of almost all the awarded sub-projects are seems to be satisfactory.

Table-5: Field Monitoring Status of CRG Sub-projects

SL #	Division/Unit	No. of Sub-projects	Sub-projects Monitored	Monitored by TD, BARC	Monitored by PIU-BARC
1	Crops	62	56	32	36
2	Fisheries	30	19	05	15
3	Livestock	26	26	26	10
4	AERS	10	10	10	04
5	Planning &Evaluation	10	08	05	04
6	Soil	19	09	-	09
7	Forest	11	06	03	03
8	Agril. Engg	16	12	03	09
9	Nutrition	06	06	06	03
	Total	**190**	**152**	**90**	**93**

A partial view of field monitoring at SAU (Sylhet)

A partial view of field monitoring at SAU (Sylhet)

A partial view of field monitoring at BARI

A partial view of field monitoring at BARI

A partial view of field monitoring at BARI

A partial view of field monitoring at BRRI

A partial view of field monitoring at RARS, BARI, Jessore

A partial view of field monitoring at BAU

A partial view of field monitoring at BINA

A partial view of field monitoring at BAU

4.3: Organized Monitoring Workshop

The PIU-BARC, NATP-2 has organized two day long one Monitoring Workshop to assess the implementation progress of the awarded CRG sub-projects. All PIs and Co-PIs of the CRG sub-projects as well as Focal Points of the recipient organizations were attended in the said workshop .Monitoring teams of all Technical Divisions of BARC and PIU-BARC have presented their field monitoring reports by power points. After presentation, most of the participants took part in the discussion and after threadbare discussion the following suggestions/ recommendations were made:

1. Sub-project activities should be initiated as per schedule.
2. Duration of the CRG sub-projects should be extended at least one year in order to generate demand driven agricultural technologies and spend the committed expenditure.
3. Monitoring process should be strengthened to ensure operation and implementation of the research projects.
4. Socio-economist should be included in socio-economic studies related research projects.
5. Developed technologies should be disseminated to the farmers /users.
6. Manufacturers should be trained for fabricating the developed Agricultural Machineries.
7. Manpower should be increased at PIU-BARC for smooth running the project activities.

A partial view of Lnaugural session of Monitoring Workshop on CRG sub-projects

A partial view of concluding session of Monitoring Workshop on CRG sub-projects

4.4: Coordination Build-up

Four visits have been done by the Director and Research Management Specialist of PIU-BARC at BARI, BINA, BAU and SAU (Sylhet) to build -up coordination with the stakeholders. All the PIs of the respective recipient organizations presented their implementation progress of the CRG sub-projects by Power Point. After threadbare discussion with the PIs and institutional authority (DG/Director-Research/Director- BAURES/SAURES), visited/monitored the field/lab activities of CRG sub-projects are being implemented. Attempt has also been taken to visit/monitor other institutes.

A partial view of Coordination Build-up meeting at BARI

A partial view of Coordination Build-up meeting at BAU

A partial view of Coordination Build-up meeting at SAU (Sylhet)

Chapter 5

Environmental and Social Safeguard Management

The Environmental and social safeguard management in NATP-2 is considered as a major integral part of the project activities. Environmental and social safeguard are not viewed in isolation, but are integrated with the overall project activities as cross cutting issue. For addressing environmental and social safeguard management,Environmental Management Framework (EMF) along with Pest Management Plan (PMP) and Social Management Framework (SMF) were developed with an aim to provide inputs into the design of NATP-2 in accordance with the World Bank Operational Guidelines through identification of key environmental and social issues arising out of the proposed project activities and mainstreaming the environmental and social safeguard management measures in all stages of the project cycle (project preparation, project implementation and project operation). The EMF along with PMP and SMF were prepared to ensure that:

i) Environmental and social considerations are fully mainstreamed in project planning, implementation, operation and monitoring;
ii) Pest Management Plan developed and disclosed are complied with; and
iii) The potential adverse impacts, if any, are adequately mitigated and potential benefits of the project are further enhanced to improve the effectiveness and sustainability of the project.

The EMF and SMF reports of the NATP-2 indicated that the project shall have no major adverse environmental and social impact. The environmental and social safeguards are to be applied to all the research sub-projects in different stages of the project cycle.

5.1: Environmental Safeguard Management

The environmental safeguard policies of the World Bank triggered in NATP-2 are Environmental Assessment (OP 4.01) and Pest Management (OP 4.09). NATP-2 has been classified as a Category B project under OP/BP 4.01 with a partial assessment as the environmental impacts are likely to be small-scale, site specific and with no irreversible impacts. Mitigation measures can be designed readily. In tune with the requirements of the OP 4.01 & OP 4.09, Environmental Management Framework (EMF) and Pest Management Plan (PMP) have been prepared and disclosed to public prior to Project Appraisal of NATP-2. Key environmental issues that will need to be addressed under NATP-2 include: (i) Potential soil degradation; (ii) potential pollution of the eco-system with agro-chemicals, particularly in ponds and water bodies; (iii) potential pesticide-related health and safety issues; (iv) food safety issues; (v) possible depletion of groundwater due to irrigation; (vi) saline water intrusion in groundwater and surface water in selected sites. The EMF provides details on potential environmental risks in AIF sub-projects and other project activities, and outlines procedures to mitigate any potentially adverse environmental impacts; the EMF also provides further guidance for setting up a mechanism for environmental monitoring as well as for capacity enhancement. The EMF included relevant environmental codes of practices to avert negative impacts and strengthen positive outcomes expected to be generated from project interventions. The PMP focuses to address pest infestation and pesticides related issues in NATP-2 and also focuses on the promotion of IPM technologies, judicious use of nationally approved pesticides, environmental code of practices for nutrient and pest management, and creation of awareness about soil and nutrient management.

5.2: Social Safeguard Management

Following the social assessment undertaken for the preparation of SMF, OP 4.12 (Involuntary Resettlement) was not triggered. No land will be acquired under NATP-2. Potential issues related to

resettlement in AIF sub-projects are not expected; should any arise during implementation, they will be addressed adequately, based on the provisions and guidelines incorporated in the SMF. However, OP 4.10 (Indigenous Peoples) has been triggered because the geographic coverage of the current project NATP- 2 has been extended, it is expected that the project also operates in areas where small ethnic and vulnerable communities live. The Social Management Framework (SMF) of NATP-2 included a Gender and Inclusion Framework (GIF) focused on participatory processes, social inclusion and accountability. So all sub-projects should follow the guidelines provided in the GIF and maintain the requisite consultation processes and documentation. NATP-2 has provision to design strategies under the GIF to enhance voice, participation and inclusion of women and vulnerable groups through information dissemination, and an on-going strategy for consultation and communication. The mobilization, consultation and communication strategy focused on the above. The project actively seeks the participation of marginal, small-scale, women (including female-only households), and near-landless farmers, and specifically address their agricultural technology needs for raising productivity and incomes. The SMF of NATP-2 also included a Tribal Peoples Development Framework (TPDF) and a screening template to determine if NATP-2 project activities (in particular areas where AIF sub projects will be implemented) include small ethnic and vulnerable communities - in which case the sub-project will be required to prepare and implement a Small Ethnic and Vulnerable Communities Management Framework in compliance with the SEVC Development Framework included in the SMF. The project should ensure consultation and communication with small ethnic and vulnerable communities in an inclusive and culturally appropriate manner and seek to enhance their participation and voice in the design and implementation of AIF sub-projects that impact them. The SMF has also included a Monitoring and Evaluation Strategy for NATP-2 at the sub-project and the overall project level along with roles and responsibilities stated clearly. Third party monitoring and social accountability elements are to be highlighted and specific M & E indicators and criteria for social assessment performance have to be identified. An accessible and usable grievance redress mechanism (GRM) is to be devised in close consultation with communities. The SMF has contained implementation arrangements, reporting and budget indication.

5.3: Safeguard Management Activities Performed Under CRG and PBRG Sub-projects

Environmental and social safeguard management activities are being implemented as cross cutting issue by the PIU-BARC. It has been implementing environmental and social safeguard activities through selection processes of CRG & PBRG sub-projects, workshops, monitoring, trainings, field days, etc. The CRG sub-projects have been selected and the PBRG sub-projects are being selected considering the national research visions and themes across agriculture sub-sectors. During the reporting year (2017-2018), a number of environmental and social safeguard activities have been undertaken by the component.

NATP-2 is designed to support sustainable production practices of crops, fisheries and livestock with environment friendly and climate smart innovative technologies, and thus, it is not expected to have any adverse impacts on the environment. However, considering the safeguard policy triggered by the NATP-2 project (Environmental Assessment, Pest Management and Indigenous People), all the CRG and PBRG sub-projects under PIU-BARC are being addressed based on a) an environmental screening matrix on bio-diversity (Flora, fauna, genetic diversity, hybrids), soil quality (Organic matter, chemical fertilizer use, soil salinity, fertility status, microbial activity, heavy metal contamination, water quality), agro-chemicals (Pesticide use, pest infestation, bio-pesticides, health hazard) and pollution (Soil, water, air) along with a self screening checklist on environmental and social safeguards. All the awarded CRG and PBRG sub-projects addressed environmental and social safeguard issues directly or indirectly to improve environmental and social development through sub-project interventions. The results of most of the CRG sub-projects showed positive impacts on environmental and social development.

Eighteen CRG sub-projects addressed environmental issues such as biodiversity, mangrove ecosystems, agro-forestry, and water management. Twenty-nine CRG sub-projects addressed climate change impacts on land use system in coastal and other areas, various aspects of fish production, farming in *haor/beel* region, development of salt & submergence tolerant of rice varieties and heat tolerant of sunflower varieties, methane emission in dairy farming system and its mitigation options and low carbon farming technique. Similarly, seven CRG sub-projects were on varietal adaptation trials trying to identify varieties suitable for coastal, hill, haor/beel, barind tract Madhupur tract and monga regions. Seven CRG sub-projects focused on environment friendly farming techniques and water conservation. In addition to these, some sub-projects were related to increase productivity and production, improvement of livelihoods of farmers, soil health and water use efficiency; and strengthening of IPM approach leading to reduce the load of agrochemical uses at farm as well as at national level.

Five PBRG sub-projects addressed environmental issues such as biodiversity and agro-forestry. Seven PBRG sub-projects addressed various aspects of fish production in *haor/beel/plain* region and four sub-projects focused on various aspects of livestock production. Similarly, three PBRG sub-projects focused on environment friendly integrated farming systems. Three sub-projects dealt with the improvement of charland and coastal ecosystems. Similarly, one sub-project dealt for use of solar pump for surface water irrigation, one for the improvement of soil quality & soil health and nine sub-projects on food safety issues. In addition to these, other 10 sub-projects are related to improvement of livelihoods of farmers, and strengthening of IPM approach leading to reduce the load of agrochemical uses at farm as well as at national level.Hence, most of the sub- projects under CRG and PBRG are not only environment friendly but also improving the environment of the project areas. All the information generated through the research component and disseminate to extension components will enhance crop, livestock and fisheries production in the country through promoting environment friendly technologies. The major **p**ositive and effective activities to ensure environmental and social safeguard management measures through some CRG and PBRG sub-projects which are illustrated in Table 6 and 7.

Table-6: Positive and Effective Activities to Ensure Environmental and Social Safeguard Management Measures through CRG Sub-projects

Sl. No.	Environmental Issue/ Areas of Sub-projects	Environmental and Social Safeguard Issues Addressed	Remarks
1	Biodiversity	Biodiversity conserved, Social safeguard ensured and Indigenous knowledge conserved through collection and characterization of important plant genetic resources including forest and medicinal plants. Enhanced genetic improvement on crops, fish and livestock species.	Awarded eleven sub-projects
2	Mangrove ecosystem in the Sundarban	Improved environment through the development of climate resilient mangrove ecosystem.	Awarded one sub-project
3	Madhupurgarh ecosystem	Biodiversity conserved, vegetation expanded and enhanced resources conservation through agroforestry as well as improved livelihood of the farming community through system approach.	Awarded one sub-project
4	Coastal ecosystem	Environmental and social safeguard issues are well addressed and livelihoods of farmers will be improved through the interventions of these sub-projects. For example, farmers in the coastal area will be benefited using Perna *viridis* farming system as blue economy.	Awarded nine sub-projects
5	Rooftop gardening	Rooftop gardening is popularizing, increased vegetables and fruits production, expanded vegetation, improved environment through reducing CO_2 in the air.	Awarded three sub-projects

Sl. No.	Environmental Issue/ Areas of Sub-projects	Environmental and Social Safeguard Issues Addressed	Remarks
6	Upscaling of lac production technologies	Utilization of beneficial insect enhanced; employment opportunities generated for women along with poverty reduction of the ultra poor and marginal farmers.	Awarded one sub-project
7	Char land ecosystem	Food security and nutrition enhanced and livelihoods of ultra poor farmers in char areas will be improved through introducing high value and nutrient rich crops along with enhancement of productivity of kenaf.	Awarded two sub-projects
8	Haor and beel ecosystem	Environmental and social safeguard issues are well addressed and livelihoods of farmers will be improved through the interventions of these sub-projects. For example, Fish production will be increased and sustained and livelihoods of farmers and fishermen will be improved through adopting improved management.	Awarded seven sub-projects
9	Integrated Pest Management (IPM)	Pesticide use reduction targeted; conservation of beneficial insects promoted, enhanced safe food production and reduced health hazards. Use of IPM reduces environmental pollution and reduces the cost of production and increases the availability of safe vegetables in the market. Use of pesticide reduced; the livelihood of the farmers improved through increased vegetables, tea, soybean, cotton and fruits production.	Awarded four sub-projects
10	Soil quality/ Soil degradation	Soil health improved through management of acid soils for sustainable crop production in Madhupur Tract and Northern & Eastern Piedmont Plains. Soil health improved, farmers' income increased, Improved livelihood of the farming community through implementation of conservation agricultural practices.	Awarded three sub-projects
11	Biofertilizer upscaling	Use of inorganic fertilizer reduced; enhanced soil heath, nutrient use efficiency and organic matter content; reduced GHG emission and increased rice yield.	Awarded two sub-projects
12	Compost, vermicompost and tricho-compost production	Improved organic farming, employment generating opportunities increased particularly for women. Improved soil health and reduced the use of chemical fertilizers resulting in reduced environmental pollution through the production of compost, vermicompost and tricho-compost from household organic waste.	Awarded three sub-projects
13	Methane emission	Methane gas emission will be reduced in dairy production systems applying existing feed resources through GLEAM model under different climatic zones of Bangladesh and identified mitigation options.	Awarded one sub-project
14	Pesticide related health and safety issues	Food safety will be ensured and farmers will be benefited through knowing adulterated pesticides and residual effects.	Awarded two sub-project
15	Food safety issues	Food and nutritional safety issues are being adequately addressed through improving crop, livestock and fish production in terms of quality and quantity. Food safety will be improved through quantitative analysis for the toxic chemical residues in fruits and vegetables selling in the markets; quantitative analysis of bottled drinking water and evaluation of pesticides residue of raw, washed & cooked vegetables; residual assessment of hazardous pesticides and antibiotics in shrimp/prawn farming systems of south-west Bangladesh; production of low cholesterol mutton by using herbs; nutritional analysis and popularization of minor fruits, popularization of organic vegetable production, etc.	Awarded twelve sub-projects

Table-7: Positive and Effective Activities to Ensure Environmental and Social Safeguard Management Measures through PBRG Sub-projects

Sl. No.	Areas of sub-projects/Environ-mental issue	Environmental and social safeguard issues addressed	Remarks
1	Biodiversity	Biodiversity will be conserved, Social safeguard will be ensured and indigenous knowledge will be conserved through collection and characterization of important plant genetic resources including forest and medicinal plants. Small indigenous fish species (SIS) will be conserved, and farmers' income will be increased.	Awarded four sub-projects
2	Char land ecosystem	Soil organic matter will be enhanced and livelihoods of ultra poor farmers in char areas will be improved and women empowerment will be enhanced through the introduction of improved agro-forestry practices and agricultural technologies along with adaptation of high-value crops and development of business model in char land ecosystem of Bangladesh.	Awarded three sub-projects
3	Coastal ecosystem	Soil organic matter will be enhanced and livelihoods of farmers will be improved through Climate Resilient Participatory Farming Systems Research. Highly stress tolerant rice cultivars will be developed through introgression of multiple salt tolerance loci (QTLs) into commercial cultivars.	Awarded two sub-project
4	Haor and beel ecosystem	Fish production will be increased and sustained and livelihoods of farmers and fishermen in haor and beel areas will be improved through adopting improved management approach.	Awarded one sub-project
5	Upscaling of solar pump	Use of solar pump for surface water irrigation in southern region of Bangladesh will save energy and improve environment by reducing fossil fuel burning.	Awarded one sub-project
6	Soil quality/Soil degradation	Soil pollution will be reduced and soil health will be improved through amendment of acidic, saline and heavy metal polluted soils using biochar for sustainable crop production.	Awarded one sub-project
7	Food safety issues	Food and nutritional safety issues are being adequately addressed through improving crop, livestock and fish production in terms of quality and quantity. Food safety will be improved through identifying contaminants and adulteration in food chain and their prevention through improved postharvest practices. Post-harvest losses will be decreased and quality crop, livestock & fish production will be increased; and livelihoods of farmers will be improved by increasing farmer's income and food/nutritional safety will be ensured. Nutritional safety will be enhanced through determining critical limit of plant nutrients for major crops.	Awarded nine sub-projects

5.4: Implementation, Coordination and Institutionalization

Implementation, coordination and institutionalization are the key factors for success and sustainability of any project activity. In view of this, PIU-BARC organized a series of workshops on implementation process, annual research progress, annual monitoring progress, etc. of CRG and PBRG sub-projects. In the implementation process workshops of CRG & PBRG sub-projects, all the Coordinators / PIs / Co-PIs have been advised to follow the environmental and social safeguard implementation guidelines in the sub-projects. The workshops have sensitized the stakeholders and

participants. Environmental and social safeguard management issues have been institutionalized through the focal persons of the research proponent institutes/organizations where research proponents are being acted as focal persons.

5.5: Women Participation, Empowerment and Mainstreaming

PIU-BARC always encourages women participation in all the activities undertaken in the unit as equal opportunity basis. Women are working as PIs (22) or Co-PIs in many research sub-projects and took part in the project activities. Besides, some other women including female farmers in the project areas are also involved in project activities particularly training programs, workshops, field days, etc. CRG and PBRG research programs have created ample opportunities for economic development and identify special requirements for enhancement of women activities, power sharing and leadership opportunity through women participation in the project. Women friendly technologies are also developed through these programs. No problem faced by women in the project. Hence, mainstreaming of women is progressing through project activities.

5.6: Environmental and Social Safeguard Compliances

Reviewed and verification of all 226 CRG and PBRG sub-projects covering different aspects of crop, livestock and fisheries showed satisfactory compliance with safeguard measures based on exclusion criteria and environmental screening matrix. CRG and PBRG sub-projects were selected on competitive basis following the guidelines described in AIF-1 and Project Implementation Manual (PIM). All the sub-project activities are being performed in transparent way. Moreover, observations reveal that any PIU-BARC activity under CRG & PBRG sub-projects covering crops, livestock and fisheries does not involved in land acquisition, involuntary resettlement, encroachment of reserve forests, and use of prohibited pesticides, etc. No complain has been received from any one either from female or male working under the sub-projects and any other stakeholder of the project due to any activity of the component. Finally, all the Coordinators/ PIs/Co-PIs are aware of environmental and social safeguard management than before. The above information reveals that all the project activities of PIU-BARC implemented in the reporting year are met with total compliances to environmental and social safeguards.

Chapter 6

Human Resource Development (HRD)

Human resources are the vital force of national development. A nation is said developed in accordance with the development of its human resources. Bangladesh is a resource –poor country and her economy mainly depends on agriculture. The agricultural development depends on its sustainable technology generation in all sub-sectors by the adoption of scientific knowledge in view of food and nutrition security and their uses by the end users. Thus agricultural manpower development is essential and more emphasis needs to be given to the research scientists. It is essential to develop research scientists in such a way that they can face the future research challenges in all sectors of agriculture. To overcome challenges and to achieve the national goal, highly skilled and competent scientific manpower is essential for generating and transferring agricultural technologies at farmer's level. As such, efforts must be made to raise the skilled scientific personnel who can strive to produce the additional amount of food and other essential agricultural products requires for an increasing population.

6.1: Status of Higher Studies (Local and Foreign PhD)

Project funding for the PhD programs is mainly targeted for outstanding medium-level NARS scientists. As per DPP of NATP-2, 140 (One hundred forty) PhD programs are targeted to be completedat local and foreign universities. Among the 140 PhD programs, 80 (Eighty) are allocated for local and the rest 60 for foreign universities. Among the 80 local PhD programs, 60 are allocated for NARS scientists and the rest 20 for mid-level civil servants of DAE (10), DLS (05) and DOF (05). PIU-BARC, NATP-2 has already been selected and awarded 120 PhD programs (60 foreign and 60 local) to the scientists of NARS Institutes (118) and Ministry of Agriculture (02). PhD candidates have been selected following Government rules and criteria on the competition basis. Preferences have been given to those areas which are emerging issues but qualified scientists are lacking.

Award letter for 60 local PhD programs have already been issued to the 60 scientists of the NARS institutes while 50 scientists have completed their admission in different public universities of Bangladesh and the rest 10 scholars are under process of admission. Out of 20 local PhD programs allocated for DAE, DLS and DOF, 10 PhD programs have already been awarded to the Officials of DAE. Selection of candidates for the PhD programs of DLS and DoF are under process.

On the other hand, award letter for 60 foreign PhD programs have been issued to the 60 scholars of NARS institutes (58) and Ministry of Agriculture (02). Out of 60 foreign PhD programs, 45 and 15 are allocated for Developing and Developed countries respectively. Until now, 06 (six) foreign PhD scholars have already been placed in two developing countries such as 01 in Philippines and 05 in Malaysia respectively. Rest 54 foreign PhD scholars will complete their admission within September 2018. List of awarded Foreign and Locan PhD along with research title attached in Anex-III (a) & (b).

Table- 8: Institute Wise List of Awarded Local and Foreign PhD Programs

SL#	Name of Institute	No. of Awarded PhD		
		Local	Foreign	Total
1.	Bangladesh Agricultural Research Institute (BARI)	21	19	40
2.	Bangladesh Rice Research Institute (BRRI)	06	10	16
3.	Bangladesh Institute of Nuclear Agriculture (BINA)	04	05	09
4.	Bangladesh Jute Research Institute (BJRI)	05	04	09
5.	Bangladesh Sugar Crop Research Institute (BSRI)	05	04	09
6.	Bangladesh Tea Research Institute (BTRI)	01	01	02
7.	Soil Resources Development Institute (SRDI)	04	03	07
8.	Bangladesh Sericulture Research & Training Institute (BSRTI)	03	-	03
9.	Bangladesh Fisheries Research Institute (BFRI)	06	05	11
10.	Bangladesh Livestock Research Institute (BLRI)	02	04	06
11.	Bangladesh Forest Research Institute (BFRI)	02	02	04
12.	Cotton Development Board (CDB)	01	01	02
13.	Ministry of Agriculture (MoA)	-	02	02
14.	Department of Agricultural Extension	10	-	10
	Total	**70**	**60**	**130**

Local PhD Programs

Table-9: Discipline Wise List of Awarded Local PhD Programs

Sl No	Name of Discipline	Scholars from Institute	No. of Awardees
1	Agronomy	BARI-3, BRRI-1, BJRI-3, BSRI-3, BINA-1, Agronomy-1	12
2	Horticulture	BARI-4	4
3	Breeding	BARI-5, BRRI-1, BJRI-1, BSRTI-1	8
4	Entomology	BARI-1, BSRI-1, CDB-1	4
5	Pathology	BARI-3	3
6	Soil Science	BARI-1, BINA-2, SRDI-4, BFRI-1, BTRI-1, BSRTI-1	9
7	Biotechnology	BARI-1	1
8	Agricultural Economics	BARI-1, BINA-1, BLRI-2	4
9	Post Harvest	BARI-1	1
10	Agricultural Engineering	BRRI-1, BSRI-1	2
11	ICT	BARI-1	1
12	Agricultural Extension	BRRI-1	1
13	Agricultural Statistics	BRRI-1	1
14	Grain Quality and Nutrition	BRRI-1	1
15	Jute Textile	BJRI-1	1
16	Fisheries	Fish breeding-1, Aquaculture-2, Management-1, Biodiversity-2	6
17	Forest	BFRI-1	1
		Total	**60**

Foreign PhD Programs

Table-10: Discipline Wise List of Awarded Foreign PhD Programs

SN	Name of Discipline	Scholars from institute	No. of Awardees
1	Agronomy	BARI-4, BRRI-2	6
2	Horticulture	BARI-3, BINA-1	4
3	Genetic Resources	BRRI-1	1
4	Breeding	BARI-5, BRRI-3, BJRI-2, BSRI-1, BINA-3	14
5	Entomology	BARI-1, BJRI-1, BTRI-1	3
6	Pathology	BARI-1, BRRI-2, BJRI-1, BSRI-1	5
7	Soil Science	BARI-2, BSRI-1,BINA-1, SRDI-3	7
8	Biotechnology	BRRI-1, BSRI-1, CDB-1,BARI-1	4
9	Agricultural Economics/ Economics	BARI-1, MoA-1	2
10	Post Harvest	BARI-1, BRRI-1	2
11	Livestock	Goat & Sheep production-1, Animal production-2, Microbiology-1	4
12	Fisheries	Fish breeding-1, Pathology-1, Breeding-2, Shrimp culture-1	5
13	Forest	Wood science-1, Wildlife-1	2
14	Women Agriculture	MoA-1	1
		Total	**60**

6.2: Staus of Training (Local and Foreign)

Local Training

PIU-BARC, NATP-2 has conducted 24 skill development local training programs in different areas against the targeted 21 during the reporting year. A total of 800 participants from 12 NARS institutes were attended in these training programs.The venues of the local training programs were BARD, BIM, GTI, NATA, BAU, BARI and BARC while the duration of local training programs ranged from 3-14 days. A brief description of the conducted local training programs is given below:

a) Training on Budget and Financial Reporting

A two-day long training program on Budget and Financial Reporting was organized at the Training Centre of Bangladesh Institute of Management (BIM), Dhaka by the PIU-BARC, NATP-2 during 17-18 November, 2017. Mr. Shah Muhammad Nasim ndc, Additional Secretary, Ministry of Agriculture (MoA) and Project Director, PMU, NATP-2 was the chief guest and Dr. Md. Kabir Ikramul Haque, Director, PIU-BARC, NATP-2 attended as a special guest in the inaugural session of the training program. Mr.Tanvir Hossain,

Inaugural session of the training at BIM, Dhaka

Management Counselor, BIM, Dhaka presided over the inaugural session. The participants of this training program were the scientists and officers of BARC and PIU-BARC, NATP-2. The training will lead the PIU-BARC, NATP-2 and BARC personnel to prepare, manage, monitor, control and evaluation of financial planning, budget & budgetary control management, variance analysis for the planned expenditure. It would help overall organizational development by financial management and reporting.

b) Training on Monitoring and Impact Assessment

Participants of the training program at BIM, Dhaka

A three-day long training program on Monitoring and Impact Assessment was organized by BIM with the collaboration and financial support of PIU-BARC, NATP-2 during 24-27 November, 2017 at the Training Centre of BIM, Dhaka. Mr. Shah Muhammad Nasim ndc, Additional Secretary, MoA and Project Director, PMU, NATP-2 was the chief guest in the inaugural session of the training program. Mr. Md. Mokhlesur Rahman, Training and Communication Specialist, PIU-BARC, NATP-2 attended as a special guest while Mr. Tanvir Hossain, Management Counselor, BIM, Dhaka presided over the inaugural session. The participants of this training program were the scientists and officers of BARC and PIU-BARC, NATP-2. The key features of this training program were a) Description of the problem before the interventions, b) Benchmarks' for activities and immediate outputs, c) Data collection on inputs, activities and immediate outputs, d) Design to provide information on administrative, implementation and management issues as opposed to broader development effectiveness issues, elements of result monitoring, e) Baseline data to describe the problems or situation before the intervention, f) Indicators of outcome, g) Systematic reporting with more qualitative and quantitative information, and h) Captures information on success or failure of partnership strategy in achieving desired outcomes. This training event provided an opportunity for the participants to share ideas, views and thoughts as well as helps to develop more confident to work and also to gain proper knowledge in every single document of field operation and monitoring.

c) Training on Financial Management

A ten day long training program was arranged at the Training Centre of BIM, Dhaka by PIU-BARC, NATP-2 during 01-10 January, 2018. Mr.Md. Mokhlesur Rahman, Training and Communication Specialist, PIU-BARC, NATP-2 and Dr. Perveen Ahmed, Director (Training), BIM were the chief guest and special guest respectively while Mr.Tanvir Hossain, Management Counselor, BIM, Dhaka presided over the inaugural session of the training. 29 scientists and officers of NARS institutes were the participants. The aim of the course was an introduction to the building blocks and architecture of a typical financial management system.The key features of this training were a) Financial management framework, b) Fundamental of financial management, c) Strategic planning and budget preparation, d) Project financial management, e) Financial and performance reporting, f) Internal control and financial security process, g) Financial statement analysis for management decision making, h) Delegation of financial power, i) VAT management, and j) Income tax management. The program will lead the NARS institute personnel to manage monitoring, control and evaluation of financial management leadership skills.

d) Training on Public Procurement Management

A ten day long training program on Public Procurement Management was arranged at the Training Centre of BIM, Dhaka by PIU-BARC NATP-2 during 3-12 April, 2018. Dr. Perveen Ahmed, Director (Training), BIM and Mr.Md. Mokhlesur Rahman, Training and Communication Specialist, PIU-BARC, NATP-2 were the honorary guests in the inaugural session of the training program. Mr. Tanvir Hossain, Management Counselor, BIM, Dhaka presided over the session. 29 scientists and officers of NARS institutes were the participants.The key features of this training were: Introduction of PPA 2006 and PPR 2008, public procurement committees, procurement cycle, national integrity strategy, method of procurement for works, standard procurement document, tender data sheet, request for quotation, methods of procurement for goods, procurement of non-consulting services, tender validities, securities, procurement of advertisement, concept of contract, public money and budget management act 2009, tender opening and evaluation, proposal data sheet exercise and file management.This training would help the participants for better understanding of the role of completion, non-discrimination and transparency in achieving "Value for money" in public procurement options.

e) Training on ICT in Agriculture

A 05 day long training program on ICT in Agriculture was organized at the Training Centre of National Agricultural Training Academy (NATA), Gazipur by the PIU-BARC, NATP-2 during 28 January- 01 February, 2018. Mr. Munshi Mohammad Hedayet Ullah, Director General (In charge), NATA, Gazipur was the chief guest, while Mr.Md. Mokhlesur Rahman, Training and Communication Specialist, PIU-BARC, NATP-2 and Dr. Md. Abu Sayeed Mian, Director (Training), NATA were attended as special guests. Dr. Md. Sayedur Rahman, Deputy Director, NATA presided over the inaugural session. 30 scientists and officers of NARS institutes attended the training program.The aim of the course was to improve the participant's skill in preparing and analyzing ICT tools and apply the knowledge in day to day works as well as to acquire advance knowledge and skill on ICT, e-governance, e-filling, ICT based software, national portal framework-service, mobile ICT and GIS in agriculture. The key features of this training were: a) ICT for agricultural development, b) Mobile ICT and GIS in agriculture, c) E- filling, d) Use of essential software in agriculture, and e) National portal content management.The program would lead the NARS institute personnel to manage ICT and computer skill.

f) Training on Research Methodology

Two batches of training each having fourteen days duration were organized at the Graduate Training Institute (GTI), BAU, Mymensingh by PIU-BARC, NATP-2 during 6-19 March, 2018 and 31 March to 13 April, 2018 The objective of the training program was to enhance the managerial capabilities of the researchers through training by increasing knowledge and practical skills on planning, implementing, monitoring and evaluation of agricultural research program. Dr. Yahia Mahmud, Director General, BFRI, Mymensingh was the chief guest in 1st batch while Mr. Shah Muhammad Nasim ndc, Project Director (Additional Secretary), PMU, NATP-2 was the chief guest in 2nd batch. Mr.Md. Mokhlesur Rahman, Training and Communication Specialist, PIU-BARC, NATP-2 and Dr. Md. Abdul Jalil Bhuyan, Research Management Specialist, PIU-BARC, NATP-2 were attended as special guests while Mr. AKM Rafiqul Islam, Director, GTI, BAU, Mymensingh presided over the inaugural sessions. The numbers of participants were 30 scientists of NARS institute in each of the batch.The key features of this training were: Research concepts and objectives, method of conduct research, fundamental basis of research planning, research management approach, research process and criteria of good research, general principle of scientific writing, title and keyword of an article,

data presentation in a scientific article, introduction of an article, methodology of an article, results and discussion, summery and conclusion, abstract writing, quoting reference, seminar paper presentation, and publishing online journal, standard reference style, bibliography using software, basic concept of statistics, descriptive and inferential statistics, measures of dispersion, SPSS and data entry, correlation and regression analysis with SPSS, multiple regression analysis with SPSS, logistic regression, profit analysis, X^2 test, polynomial regression analysis with SPSS, use of field plot techniques in agricultural research, basic principles of experimental design, CRD & RCBD single and two factor, split plot analysis, latin square design, multiple comparison test, covariance analysis, path analysis, data transformation, pooled analysis, time series analysis and exploratory data analysis. Dr. Miah Sayeed Hasan, Director PIU-BARC NATP-2 was the chief guest and Mr. Md. Mokhlesur Rahman, Training and Communication Specialist, PIU-BARC NATP-2 attended as a special guest while Mr. AKM Rafiqul Islam, Director, GTI, BAU, Mymensingh presided over the closing session.

g) Training on Administrative and Financial Management

A fourteen days long training program on Administrative and Financial Management was arranged at the Training Centre of Bangladesh Academy for Rural Development (BARD), Kotbari, Comilla by PIU- BARC, NATP-2 during 1-14 February, 2018. Dr. M. Mizanur Rahman, Director General, BARD presided over the inaugural session. Mr. Md. Mokhlesur Rahman, T&C Specialist, PIU-BARC, NATP-2, Mr. Md. Shafiqul Islam, Director (Research), BARD and Mr. Milan Kanti Bhattacharjee, Director (Training), BARD were the guest speakers in the inaugural session. The numbers of participants in this course were 29 scientists of NARS institutes. The aim of the course was to adapt concepts and ideas of modern management procedures in development by the participants; acquaint the participants with the rules and regulations related to office administration and enhance knowledge and skills on financial rules. The key features of this training were: Agricultural policy in Bangladesh, concept, principle, role of modern office management, strategic planning, good governance, result based management, recruitment rules of autonomous and semi-autonomous organizations, office confidence, office record management, note writing and initiating a file, conduct office meeting and preparation of minutes, interpersonal relationship,office security, leave rules, performance appraisal and ACR writing, office supervision, communication, decision making, discipline and appeal rules, procedures for disciplinary enquiry and action with exercise, financial and treasury rules, procedure of public accounts keeping, delegation of financial power, duties and responsibilities of drawing and disbursement officers, public procurement rules-2008, mid term budgetary framework (MTBF), warrant of precedence, advance and adjustment procedures and preparation and approval of TA bills. The concluding session of the course was chaired by Dr. M. Mizanur Rahman, Director General, BARD while Dr. Miah Sayeed Hasan, Director, PIU, BARC, NATP-2 and Mr.Md. Mokhlesur Rahman, Training and Communication Specialist, PIU-BARC, NATP-2 were the special guests.

h) Training on Integrated Pest Management of Major crops

PIU-BARC, NATP-2 has organized a five day long training program on Integrated Pest Management of Major crops at BARI, Gazipur during 21-25 April, 2018. Dr. Miah Sayeed Hasan, Director, PIU, BARC, NATP-2 was the chief guest while Director (Training) and Director(Research), BARI were attended as special guests and Dr. Syed Nurul Alam, Director (Planning & Evaluation), BARI chaired the inaugural session. The numbers of participants were 30 scientists of NARS institutes. The key features of this training were: Different common practices of IPM application in Bangladesh, insect classification, chemical pesticides, bio-pesticides, biological control, description of pests and their life cycle, integrated pest management of different crops, integrated pest management of stored grain, biological control of insect pests, effect of DDT, the effect of milder and shorter winters for pest outbreaks, characteristics of pheromone etc.

i) Training on Reproductive Health Management in Ruminants

A five day long training program on Reproductive Health Management in Ruminants was arranged at the Veterinary Science Auditorium, BAU, Mymensingh by PIU-BARC, NATP-2 during 3-7 June, 2018. Dr. Priya Mohan Das, Dean, Faculty of Veterinary Science, BAU was the chief guest in the inaugural session. Dr. Miah Sayeed Hasan, Director, PIU-BARC, NATP-2 attended as special guest and Dr. Farida Yeasmin Bari, Head of Department, Faculty of Veterinary Science, BAU chaired the inaugural session. The numbers of participants were 30 scientists and officers of NARS institute and DLS. The objective of the training was to develop expertise and clinical proficiency in the field of veterinary for management of reproductive health, care of dairy cows and breeding bulls. The key features of this training were: a)Role of veterinary profession in sustainable development of food and nutrition security, b) Management of dairy cattle nutrition, c) Functional anatomy and endocrine control of female and male reproductive system, d) Principle of ultrasonography, electrical heat and mastitis detection kit as diagnostic approaches, e) Infectious disease of reproductive system in ruminants and care of pregnant dam and neonates, f) Castration and preparation of teaser in farm animals, breeding for female animals, safe food production, management of under health and clinical mastitis, g) Anesthesia used for ruminants, ultrasonography, h) Semen collection, processing, and extender preparation, i) Hard health reproduction management and arts, sub fertility management, hormonal and antimicrobial therapy. The training was conducted successfully and all the participants took active part in five days course.

Training on Reproductive Health Management in Ruminants at BAU

j) Training on Mango Production

A two day long training program on Mango Production was arranged in three batches by the Technology Transfer and Monitoring Unit (TTMU) of BARC through the financial support of PIU-BARC, NATP-2 during 11-16 March, 2018 at Sadar, Shibgonj and Bholahat Upazillas of Chapainawabgonj district. First batch of training was held during 11-12 March, 2018 at Bholahat while the 2nd and 3rd batch were held during 13-14 &15-16 March, 2018 at Shibgonj and Sadar upazillas of Chapainawabgonj district respectively. Dr. Shaikh Md. Bokhtiar, Director, TTMU, BARC was the chief guest while UNO, Bholahat and Dr. Md. Hamim Reza, CSO, RHRC, Chapainawabgonj were the special guests in the inaugural session of the first batch. UAO, Bholahat presided over the inaugural session. Mr. Md. Mahmudul Hasan, DC, Chapainawabgonj was presented as a chief guest while Dr. Miah Sayeed Hasan, Director, PIU- BARC, NATP-2, Chairman of Shibgonj Paurasova and Dr. Shaikh Md. Bokhtiar, Director, TTMU, BARC were the special guests in the inaugural session of 2nd batch. Mr. Md. Manjurul Huda, Deputy Director, DAE, Chapainawabgonj presided over the inaugural session at Shibgonj.

k) Training on Phyto-sanitary Measures and Food Safety Issues in Bangladesh

A day long training program on Training on Phyto-sanitary Measures and Food Safety Issues in Bangladesh was organized by the Crops Division, BARC with the collaboration and financial support of PIU – BARC, NATP-2 on 9 May, 2018 at BARC, Dhaka. The objective of the training was to improve the knowledge and skills of the concerned participants on phyto-sanitary measures and food safety issues in the country. The numbers of participants in this course were 40 Scientists and Officers of BARI, BRRI, BJRI, BSRI, CDB, BSRTI, BARC, BADC, DAE, Hotex foundation and other private organizations (BRAC, ACI seed, Lal Teer Seed and Pran). Dr. Paresh Chandra Golder, Member Director (Planning and Evaluation), BARC was the chief guest and Dr.Miah Sayeed Hasan, Director, PIU, BARC, NATP-2 attended as special guest while Dr. Md. Aziz Zilani Chawdhury, Member Director (Crops), BARC chaired the inaugural session. Dr.S.M. Khurshed Alam, Director (Manpower and Training), BARC delivered the welcome address and brief presentation on program. Resource speakers were from BARI, BAU, BARC, DAE and FAO. The key features of this training were: a) Pesticide residues and food safety issues for fruits and vegetables, b) Food safety and bio-security issues for phyto-sanitary measures in Bangladesh, and c) Adulteration in food and human health hazards, regulatory framework for plant protection and sanitary and phyto-sanitary measures in fruits and vegetables supply chain.

l) Training on Bioinformatics for Sustainable Development in Agriculture

Livestock Division of BARC has organized a three day long training program on Bioinformatics for Sustainable Development in Agriculture in association with Bangladesh Bioinformatics and Computational Biology Association (BBCBA) with the collaboration and financial support of PIU-BARC, NATP-2 during 26-28 December, 2017 at BARC, Dhaka. Dr. Paresh Chandra Golder, Member Director (P& E), BARC was the chief guest and Professor Dr. Md. Nurul Haque Mollah, President of BBCBA & Head of Bioinformatics Lab, Department of Statistics, Rajshahi University was the special guest while Dr. Shah Md. Ziqrul Haq Chawdhury, Member Director (Livestock), BARC chaired the inaugural session. The participants of this training session were the scientists of NARS institutes (BLRI, BARI, BRRI, BFRI, BSRI, BJRI and BINA). Resource speakers of this training program were from BAU, BSMRAU, SAU and BARC.The key features of this training were: a) Genomic analysis, transcriptomic analysis, phylogenetic analysis, metabolomics analysis, integration of genomic and prteomic analysis for drug discovery, and b) Toxicogenomics, role of agri-informatics, drug discovery and use of common bioinformatics tools, generation sequencing tools and their use in agriculture.

Besides, 9 local training programs on different aspects were conducted during the reporting period. Two batches of training on Quality Processing and Preservation of Agro-products were organized during 3-7 December, 2017 and 10-14 December, 2017 respectively and total participants of two trainings were 60. One training program on Quality Production of Dried Fish by Herbal Method was arranged during 12-15 January, 2018 and total participant of this training was 30. All the three trainings were conducted by Nutrition Unit of BARC. Livestock Division of BARC has organized a training program titled Climate Change, Carbon Sequestration and Adaptation Strategies' during 6-8 February, 2018 and total participants were 40. A one day long training on Phyto-sanitary Measures was arranged by Livestock Division of BARC on 9 May, 2018 and total participants of this training were 40. Two day long training on Epidemiology was conducted by Livestock Division of BARC during 13-14 May, 2018 and total participants of this training were 20.

Foreign Training

a) Training on Financial and Office Management

A 08 days long foreign training program titled Financial and Office Management has been organized at the International Malaysia Education Centre (IMEC), University Malaysia Sarawak (UNIMAS) of Malaysia during 25 February to 4 March, 2018 by PIU-BARC, NATP-2. A total of 07 participants from BARC (05) and MoA (02) have been attended in the said training program. The key features of the training were: a) Manage an effective performance, b) Communication for improve office efficiency, c) Build an effective office system to drive result, d) Estimation technique, planning, time, cost, planning, HR planning, communication, risk management of project, e) Financial management and best practices in Malaysia and ASEAN region, f) Control of cost and cost value report, change of management term and management order.

6.3: Status of Local Workshop/Seminar/Meeting

A total of 22 workshops, seminars and meetings were conducted during the FY 2017-18. A total of 2512 participants were attended in those events. A day long workshop on Implementation Progress of CRG Sub-projects was held at BARC with 280 PIs and Co-PIs of CRG sub-projects. The activity plan, progress and limitations of the CRG sub-project implementation in the field were discussed. Another workshop titled Illustration on PhD Scholarship Award was organized at BARC with 150 participants to share the mode of operation of PhD programs and future activity for the PhD Scholars. A two day long seminar on Key Sequence Importance (KSI) Technique for Thesis Writing was arranged for the PhD scholars with 230 participants. The seminar was conducted by Dr. Md. Kamal Uddin, Professor University of Malaysia. He discussed how to write an improved thesis and the steps of best paper publication for the PhD scholars.

View of the PhD awardee at BARC

A one day long meeting was held on CRG Sub-project Monitoring with 70 participants to share data collection on input, activities and immediate output and the progress of the project. A one day long seminar was organized on Agricultural Mechanization with 400 participants to discuss about the improvement of agricultural mechanization. A day long meeting was held with the team members of Implementation Support Mission, WB having 90 participants from different implementing organizations of NATP-2 at BARC. Another one day long meeting was held on CRG Implementation Progress with 65 participants to discuss about the progress of CRG sub–projects under PIU-BARC, NATP-2. Three batches of day long workshop were organized on the CRG Crops sub-projects with 176 PIs & Co-PIs to discuss about the progress of CRGs.Two batches of one day long workshop was held on CRG AERS sub-projects with 140 Participants to discuss about the implementation progress and constrains of CRG AERS sub-projects. A one day long workshop was held on CRG


Partial of view of partialpants CRG monitoring workshop at BARC

sub-project (Livestock) with 56 participants to discuss the implementation progress and constrains of CRG sub-project (Livestock) and activity plan for the future. One day long workshop was held on CRG Soil sub-projects with 75 participants to discuss the implementation progress of CRG Soil sub-projects. A day long workshop was held with 60 PIs & Co-PIs of CRG Forest sub-projects to discuss the implementation progress of CRG. Forest sub-projects.Two batches of one day long workshop were held on CRG Fish sub-project with 126 participants to discuss the progress of CRG Fish sub-projects. A day long workshop was held on CRG P&E sub-projecst with 75 participants to discuss the implementation progress of CRG P&E sub-projects. Two batches of day long workshop were held on CRG sub-projects with 219 participants to discuss the monitoring progress of CRG sub-projects.

View of CRG Progress review workshop at BARC

Three batches of one day long training workshop on the Implementation Procedure of PBRG sub-projects for the Coordinators and Principal Investgators of the recipient PBRG sub-projects have been organized for smooth running of the awarded sub-projects activities. All the above mentioned programs were arranged by PIU-BARC, NATP-2 at BARC.

Inaugurtal Session of the Training workshop on Implementation Procedure of PBRG Sub-projects

View of Training workshop on Implementation Procedure of PBRG Sub-projects

Chapter 7

Procurement Management

7.1: Procurement

PIU-BARC, NATP-2 planned to procure 03 (three) Goods Packages i.e. Purchase of 3 (three) vehicle, Repair of A/C, Purchase of Substation (Transformer); 0 3 (three) Works Packages i.e. Repair and Maintenance of 2nd and 3rd floor of Administration Building of BARC, Repair and Maintenance of 3rd and 4th floor of Training Building, BARC; and 03 Service Packages i.e Hiring of Individual Consultant, Hiring of Vehicle and Servicing & Maintenance of Lift. Out of 9 packages only 1 package was funded by GoB and tender was floated through e-Gp for 4 packages. All the packages have been completed within FY 2017-18.

The pooled procurement of equipment for the PIU-BARC component i.e. computer and accessories, laptop, aircooler, multimedia projector, photocopier, furniture and so on was delegated to Project Management Unit (PMU) office. Only two packages i.e. Laptop and Online UPS were procured and the rest packages are decided for re-tendering through e-GP system in FY 2018-19.

Table-11: Procurement of Goods, Works and Services

Type of Procurement	Amount	Work Order/NoA	Remarks
Goods			
i. Purchase of 3 (three) Vehicle.	122.00	done	completed
ii. Repair of Air cooler.	5.00	done	completed
iii. Purchase of Substation (Transformer), BARC	45.00	done	continue
Works			
i. Repair and Maintenance of 2nd floor of Admin. Building, BARC	9.90	done	completed
ii. Repair and Maintenance of 3rd floor of Admin. Building, BARC	9.95	done	completed
iii. Wiring and installation of electronic equipments at Training Building (3rd & 4th floor), BARC	14.00	done	continue
Services			
i. Procurement of Individual Consultant	14.00	done	completed
ii. Hiring of Vehicle-1	5.00	done	completed
iii. Servicing & Maintenance of Lift, Admin Building.	0.82	done	continue

Table-12-: RADP Allocation and Achievement of Procurement

Funding Source	RADP Allocation	Expenditure	Achievement (%)
	Goods		
GoB	120.00	120.00	
RPA	5.00	4.92	
Total	**125.00**	**124.92**	99.94
	Works		
GoB	-		
RPA	40.00	34.55	
Total	**40.00**	**34.55**	86.38
	Services		
GoB	-	-	
RPA	18.41	17.89	
Total	**18.41**	**17.89**	97.18
Grand Total	**183.41**	**177.36**	**96.70**

Table-13: Package Wise Target and Achievement of Procurement

(No. of packeges)

Goods			Works			Services			Total		
Target	**Achievement**	**(%) 3/2* 100**	**Target**	**Achievement**	**(%) 6/5* 100**	**Target**	**Achievement**	**(%) 9/8* 100**	**Target**	**Achievement**	**(%) 12/11* 100**
2	3	4	5	6	7	8	9	10	11	12	13
3	**3**	**100 %**	**3**	**3**	**100 %**	**3**	**3**	**100 %**	**9**	**9**	**100 %**

7.2: Procurement of Consultants

As per DPP, PIU- BARC, NATP-2 has already procured the Research Management Specialist, Training and Communication Specialist, Manager (Financial Management) , Procurement Specialist, Assistant Manager (Administration) and Assistant Manager (Accounts) (Annex-IV). Procurement of rest of the consultants such as Monitoring & Evaluation Specialist, Assistant ICT Specialist, and Environmental and Social Safeguard Specialist are under process.

7.3: Recruitment of Core Contractual Staffs

Out of 18 core contractual staffs, 15 have already been procured for smooth running of the project activities (Annex-IV). The rest of the core contractual staffs will be procured soon.

Chapter 8

Financial Progress

8.1: Project Financial Management

Project financial management is a process by which the components like planning, budgeting, accounting, financial reporting, internal controls, disbursement, and physical performance of the project and auditing are brought together. Sound financial management is a vital to project success.It will help to perform project activities more efficiently by reducing in-progress delays or bottlenecks, speeding disbursements and facilitate project monitoring. Poorly structured financial management system distorts project's expenditure, increases cost of running business, and fosters waste or corruption.

8.2: Principles of Project Financial Management of PIU-BARC

The accounting policies and procedures of the PIU-BARC are governing by the existing Project Accounting Manual issued by Ministry of Finance in consultation with the Comptroller and Auditor General of Bangladesh. All transactions of PIU-BARC are being accounted for following double-entry book keeping principles and on a cash basis. Special account funds have been treated as PA which is being spent as local/ foreign exchange cost as required. PIU-BARC is maintaining 4 (four) separate operating/current accounts in Agrani Bank Ltd, Farmgate Branch, Dhaka for RPA and GoB fund.

8.3: Cost of PIU-BARC as per DPP

Government of Bangladesh and the World Bank agreed that a long–term programmatic approach would most suitable to improve the effectiveness of the National Agricultural Technology System. So the Adaptable Program Lending (APL) instrument has applied here as the most appropriate lending instrument. The cost of PIU-BARC as per Development Project Proposal (DPP) is shown below:

Table -14: Cost of PIU-BARC under NATP-2

(Taka in lakh)

Sources	Amount	% of Total
World Bank & IFAD (RPA)	33270.20	82.61 %
USAID (RPA)	5758.00	14.30 %
GoB	1245.00	3.09 %
Total	**40273.20**	**100 %**

Table-15: Major Estimated Expenditure of PIU-BARC as per DPP

(Taka in lakh)

Sl	Items	GoB	RPA	Total
1.	All Capital Items	366.00	5597.20	5963.20
2.	CDVAT	453.00	0.00	453.00
3.	Safeguard Mitigation Measures & Price Contingency	0.00	860.00	860.00
4.	Funding of CRG	193.00	5758.00	5951.00
5.	Funding of PBRG	0.00	12842.00	12842.00
6.	Training (National & International): Higher Study & skill Dev.	0.00	7665.00	7665.00
7.	Workshop/Seminar/Meeting/Conference (ERIE)	0.00	1000.00	1000.00
8.	Consultants and Consultancy Services	0.00	3310.00	3310.00
9.	Miscellaneous & Other operational Cost	233.00	1845.00	2078.00
10.	Repair, Maintenance & Renovation	0.00	151.00	151.00
	Total	**1245.00**	**39028.20**	**40273.20**

8.4: Financial Progress of PIU-BARC

ADP allocation for the year 2017-2018 was Tk. 12885.00 (GoB Tk. 640.00 and RPA Tk. 12245.00) & Revised ADP allocation for this year (after re-appropriation) was Tk. 5118.00 (GoB Tk. 266.00 and RPA Tk. 4852.00). PIU-BARC received TK 4812.63 Lakh as RPA advance in FY 2017-18 from PMU. Total expenditure during the FY 2017-18 was Tk. 5067.23 (GoB Tk. 266.00 and RPA Tk. 4801.23). Total cumulative expenditure since inception up to 30 June 2018 was Tk. 5148.57 (GoB Tk. 307.99 and RPA Tk. 4840.58).

Table-16: Financial Progress in FY 2017-18

(Taka in lakh)

Code	Description	Original Budget			RADP			Expenditure		
A. Revenue Component		**RPA**	**GoB**	**Total**	**RPA**	**GoB**	**Total**	**RPA**	**GoB**	**Total**
4500	Salary ofofficers*	0.00	9.00	9.00	0.00	0.00	0.00	0.00	0.00	0.00
4600	Pay of	81.00	0.00	81.00	73.00	0.00	73.00	70.73	0.00	70.73
4700	Allowances	10.00	7.00	17.00	8.00	0.00	8.00	7.04	0.00	7.04
4800	Supply & services	11813.50	211.00	12024.50	4722.00	146.00	4868.00	4683.49	146.00	4829.49
4900	Repair and maintenance	59.50	0.00	59.50	49.00	0.00	49.00	39.97	0.00	39.97
5900	Grants/Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6600	Lum Grant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub Total A:		**11964.00**	**227.00**	**12191.00**	**4852.00**	**146.00**	**4998.00**	**4801.23**	**146.00**	**4947.23**
B. Capital Component										
6800	Asset acquisition	251.00	366.00	617.00	0.00	120.00	120.00	0.00	120.00	120.00
6900	Land purchase /	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7000	Construction &	30.00	0.00	30.00	0.00	0.00	0.00	0.00	0.00	0.00
7100	Share & equity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7200	Capital Grant	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7300	Credit and advance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7900	CD VAT	0.00	47.00	47.00	0.00	0.00	0.00	0.00	0.00	0.00
7980-7998	Capital Lum & others	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub Total B:		**281.00**	**413.00**	**694.00**	**0.00**	**120.00**	**120.00**	**0.00**	**120.00**	**120.00**
Grant Total (A+B):		**12245.00**	**640.00**	**12885.00**	**4852.00**	**266.00**	**5118.00**	**4801.23**	**266.00**	**5067.23**

* Salary is paid from BARC core budget

Table-17: Summary of Financial Progress in FY 2017-2018

(Taka in lakh)

Nature of Cost	Total cost as per DPP	RADP allocation	Fund released	Financial Progress (%)	Physical Progress (%)	Constraints
GoB	1245.00	266.00	266.00	266.00 (100 %)	**100 %**	
RPA	39028.20	4852.00	4812.63	4801.23 (98.95 %)		
Total	40273.20	5118.00	5078.63	5067.23 (99.01 %)		

The total expenditure incurred BDT 5067.23 lakh during July 2017 to June 2018 as against the RADP allocation BDT 5118.00 lakh for FY 2017-2018. The financial progress is 99.01%.

Chapter 9

Conclusion / Recommendation

9.1: Key Challenges Faced

- Delay of RPA fund release.
- Natural calamities like heavy and continuous rainfall as well as hailstorm delayed the initiation of some CRG sub-projects activities as per schedule.
- Duration of the CRG sub-projects is too short to generate demand driven agricultural technologies and spend the committed expenditure.
- Fund unavailability in appropriate time.
- Delay of pooled procurement.
- Delay of International Consulting Firm hiring (for overseas program).
- Inadequate manpower in PIU-BARC component.

9.2: Way Forward

- Extension of one year time for CRG sub-projects
- Timely release of RPA fund
- Recipient institutional involvement need to be strengthened.

Annex-I: Detailed List of CRG Sub-projects with Title and Principal Investgator's Name

Sl No.	Project ID	Sub-Project Title	Name of the PI and address	Institute	Division/ Unit
1	301	Development of Climate Resilient Mangrove Ecosystems in the Sundarban	Dr. M Masudur Rahman, Divisional Officer, BFRI, Muzgunni, Khulna	BFRI (Forest)	Forest
2	305	Breeding biology and induced breeding technique of the freshwater gangmagur, Hemibagrus menoda (Hamilton, 1822)	Dr. Md. Idris Miah, Professor, Department of Fisheries Management, BAU, Mymensingh	BAU	Fisheries
3	307	Improvement of Coconut Harvesting and Dehusking Machine	Dr. Md. Nurul Amin, SSO, BARI, Joydebpur, Gazipur	BARI	Agril. Eng.
4	309	Dietary effect of hydrophonic legume sprouted fodder on Turkey production in Bangladesh	Dr. Ummay Salma, Professor, Department of Animal Science and Nutrition, Hajee Mohammad Danesh Science and Technology University, Dinajpur	HSTU	Livestock
5	310	Scaling-up of farmer led agroforestry practices for livelihood improvement and resources conservation in the Madhupur Garh area	Dr. Kazi Kamrul Islam, Professor and Head, Department of Agroforestry, BAU, Mymensingh	BAU	Forest
6	311	Inhibition of arsenic accumulation in rice with phytofortification of microelements for nutritional safety	Dr. Md. Shariful Islam, Dept. of Agricultural Chemistry, Associate Professor, PSTU, Patuakhali	PSTU	Soil
7	313	Development of estrus synchronization protocols using hormones in anestrus cows for improved reproductive	Professor Dr. Md. Jalal Uddin Sarder, Department of Veterinary & Animal Sciences, University of Rajshahi, Rajshahi	Rajshahi University	Livestock
8	315	Arthropod Pests Infesting Ornamental Plants in Bangladesh: Strategies for Management	Dr. Md Ruhul Amin, Professor, Department of Entomology, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur	BSMRAU	Crops
9	316	Effects of vacuum and modified atmosphere packaging on microbiological and biochemical properties of fresh fish stored at refrigeration temperature (4 °C)	Dr. Md. Tariqul Islam, Associate Professor, Department of Fisheries, University of Rajshahi, Rajshahi	Rajshahi University	Fisheries
10	321	Seroprevalence and identification of associated risk factors of Q-fever *(Coxiellaburnetii)* in ruminants, an emerging zoonotic disease in Bangladesh	Dr. Khondoker Jahengir Alam, Associate Professor, PSTU, Khanpura, Babugonj, Barisal	PSTU	Livestock
11	323	Development of ginger production technology under soilless culture using fertigation technique in Bangladesh	Dr. Md. Ashikul Islam, SSO, Spices Research Centre, Shibganj Bogra	BARI	Soil
12	328	The Nutritional Analysis and Popularization of Minor Fruits to Rural and Urban Communities of Bangladesh	Dr. Mohammad Mainuddin Molla SSO, RARS, Akbarpur, Moulvibazar	BARI	Nutrition

Sl No.	Project ID	Sub-Project Title	Name of the PI and address	Institute	Division/ Unit
13	333	Development of green mussel Perna *viridis* farming system in coastal areas for boosting blue economy of Bangladesh	Dr. Md Asaduzzaman, Assistant Professor, CVASU, Khulshi, Chittagong	CVASU	Fisheries
14	337	Integrated Pest Management (IPM) approaches to Major Pests of Tea for sustainable tea production	Mohammad Shameem Al Mamun, SSO (Entomology), Bangladesh Tea Research Institute Sub Station, Panchagarh	BTRI	Crops
15	339	Identification of VAM and Determination of their Potentiality on Tea Cultivation	Md. Moshiur Rahman Akonda, Scientific Officer, Plant Pathology Division, BTRI, Srimangal, Moulvibazar	BTRI	Crops
16	340	Determination of residue level of commonly used pesticides in tea	Shovon Kumar Paul, SO, Entomology Division, BTRI	BTRI	Crops
17	342	BTRI Clones and Improved Seeds to the Stakeholders	Dr. Md. Abdul Aziz, Principal Scientific Officer, Botany Division, BTRI, Srimangal, Moulvibazar	BTRI	Crops
18	345	Productivity Enhancement of Promising Vegetable Varieties during Winter and Summer in Sylhet Region	Dr. Md. Shahidul Islam, Professor, Department of Horticulture, SAU, Sylhet	SAU, Sylhet	Crops
19	349	Identification of causes of high calf mortality in buffalo and their mitigation measures in Bangladesh	Prof. Dr. Md. Masudur Rahman, Dept. of Pathology, Faculty of Veterinary and Animal Science, Sylhet Agricultural University	SAU, Sylhet	Livestock
20	362	Prevalence and molecular characterization of shiga toxin producing Escherichia coli (STEC) in poultry and their products in Bangladesh	Dr. Mst. Minara Khatun, Professor, Bangladesh Agricultural University, Mymensingh	BAU	Livestock
21	363	Business Opportunities of Ornamental Fisheries in Bangladesh: Development of a Production and Economic Assessment Model	Prof. Dr. Md. Sadiqul Islam, Dept. of Fisheries Biology and Genetics, BAU, Mymensingh	BAU	Fisheries
22	364	Study on quality of fish feed, brood use and fingerlings produce in commercial fish farm of Bangladesh	Prof. Dr. Md. Shahjahan, Dept. of Fisheries Management, BAU, Mymensingh	BFRF	Fisheries
23	367	Development of Live Attenuated Duck Plague Vaccine Using Local Duck Plague Virus Strains	Professor Dr. Md. Ariful Islam, Department of Microbiology & Hygiene, Bangladesh Agricultural University, Mymensingh	BAU	Livestock
24	368	Morpho-molecular characterization of underutilized indigenous vegetables in Bangladesh	Dr. Md. Shahidul Islam, Professor, Department of Biotechnology, BAU, Mymensingh	BAU	Crops

Sl No.	Project ID	Sub-Project Title	Name of the PI and address	Institute	Division/ Unit
25	369	Development of sustainable biological weed management techniques through allelochemicals from crop residues	Dr. Md. Romij Uddin, Professor, Department of Agronomy, Bangladesh Agricultural University, Mymensingh	BAU	Crops
26	376	Adaption of a new species "Tomatillo (Physalis phyladelphica Lam./Physalis ixocarpa Brot.)"	Professor Dr. Naheed Zeba, Department of Genetics and Plant Breeding, Sher-e-Bangla Agricultural University	SAU, Dhaka	Crops
27	378	Socio-economic Impact on Wheat Research and Development in Bangladesh	Dr. Md.Abdul Matin, CSO, BARI, Gazipur	BARI	AERS
28	382	Development of existing maize based cropping patterns for sustain soil fertility in south-western region of Bangladesh	Md. Sirajul Islam, Ph.D., CSO, BARI, RARS, Jessore	BARI	Soil
29	384	Characterization and Documentation of Minor Fruits in Bangladesh with Special Emphasis on Coastal and Hilly Areas Fruits	Prof. Dr. Md. Mokter Hossain, Dept. of Horticulture, Bangladesh Agricultural University, Mymensingh	BAU	Crops
30	386	Agro-forestry for livelihood development of Jhumia community (shifting cultivators) in Chittagong Hill Tracts, Bangladesh	Dr. Md. Mahbubur Rahman, Divisional Officer, Silviculture Genetics Division, BFRI, Chittagong	BFRI (forest)	Forest
31	389	Oxidative stress tolerance of maize under drought and salinity: Mechanism and identification of stress inducible proteins	Dr. Md. Motiar Rohman, SSO, BARI, Gazipur	BARI	Crops
38	393	Cultivation, Marketing and Processing of Medicinal and Aromatic Plants (MAPs) in Bangladesh	Dr. Shaikh Abdus Sabur, Professor, Bangladesh Agricultural University, Mymensingh	BAU	AERS
33	395	Genetic improvement of indigenous cattle for beef production through crossing with Brahman cattle by farmers participatory breeding approach in Bangladesh	Dr. Md. Azharul Hoque, Professor, Department of Animal Breeding and GeneticsBangladesh Agricultural University, Mymensingh	BAU	Livestock
34	397	Seed production of Bhagna, Labeo ariza (Hamilton, 1807) through line breeding trial in Bangladesh	Dr. A. K. Shakur Ahammad , Associate Professor, BAU, Mymensingh	BAU	Fisheries
35	400	Evaluation of endocrine biopesticides against major sucking insect pests of vegetables	Dr. Gopal Das, Professor, Department of Entomology, Bangladesh Agricultural University, Mymenisngh	BAU	Crops
36	403	Characterization of Mycoplasma gallisepticum isolates from Bangladesh and their use in production of diagnostic antigen and development of vaccine candidate	Dr. Monira nor, Assistant Professor, Department of Pathology, Faculty of Veterinary and Animal Science, Sylhet Agricultural University, Sylhet	SAU, Sylhet	Livestock

Sl No.	Project ID	Sub-Project Title	Name of the PI and address	Institute	Division/ Unit
32	406	Assessment of postharvest losses based on postharvest practices and marketing performances in selected vegetable supply chains in Bangladesh	Dr. Md. Abdul Monayem Miah PSO, Planning and Evaluation Wing BARI, Joydebpur, Gazipur	BARI	AERS
37	407	Supply Chain Analysis of Major Vegetables Produce in Hill and Coastal Regions of Bangladesh	Mohammad Shamsul Hoq,SO, Agricultural Economics Division, BARI, Joydevpur, Gazipur.	BARI	AERS
39	410	Development of Sustainable Aquaculture System in the Inundated Low-laying Agriculture Land in the Coastal Region of Bangladesh	Md. Moazzem Hossain, Associate Professor, Department of Fisheries Management, Patuakhali Science and Technology University, Dumki, Patuakhali	PSTU	Fisheries
40	413	Assessment of ecosystem services and benefits of rooftop gardening for climate-friendly city development using geospatial technology	Prof. Dr. Md. Forhad Hossain, Department of Agroforestry and Environmental Science, Sher-e-Bangla Agricultural University, Dhaka	SAU, Dhaka	Crops
41	418	Growth and Productivity Assessment of Agar Plant (*Aquilariamalaccensis Roxb.*) through Management Practices	Professor Dr. Md. Abul Kashem, Department of Soil Science, Sylhet Agricultural University,Tilagor, Sylhet	SAU, Sylhet	Forest
42	419	Management of acid soils for sustainable crop production in Madhupur Tract and Northern & Eastern Piedmont Plains	Dr. Md. Anamul Hoque, Professor, BAU, Mymenisngh	BAU	Soil
43	426	Molecular characterization of Babesia, Theileria and Anaplasma organism in livestock in Bangladesh	Dr. Md. Shahiduzzaman, Professor, Bangladesh Agricultural University, Mymensingh	BAU	Livestock
136	429	Impact of Improved Aquaculture Technologies on Productivity and Livelihood of Fish Farmers in Bangladesh	Dr. Mohammad Mizanul Haque Kazal, Professor, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka	SAU, Dhaka	AERS
45	432	Achieving adaptation to climate change and sustainable livelihood throughMoringa based agroforestry practice in Bangladesh	Dr. Md. Kausar Hossain, Professor, Dept. of Agroforestry and Environmental Science, Sher-e- Bangla Agricultural University, Dhaka	SAU, Dhaka	Forest
46	439	Evaluation of tree-crop interaction from existing agroforestry systems in Sylhet region for food security by the lens of climate-smart agriculture framework	Mohammad Samiul Ahsan Talucder, Assistant Professor, Department of Agroforestry and Environmental Science, Sylhet Agricultural University, Tilagor, Sylhet	SAU, Sylhet	Forest
47	440	Tobacco replacement through high value and nutrient rich crops for food security and nutrition of charland people under Bhuapur upazilla of Tangail	Md. Asiqur Rahaman, SSO, On-Farm Research Division, Bangladesh Agricultural Research Institute (BARI), Tangail	BARI	Crops

Sl No.	Project ID	Sub-Project Title	Name of the PI and address	Institute	Division/ Unit
48	442	Increasing Productivity of Cropping System in Some Coastal Areas of Bangladesh	Dr. Swadesh Chandra Samanta, Professor, PSTU, Dumki, Patuakhali.	PSTU	P & E
49	443	Development of Effective Vaccine Against Bovine Mastitis	Dr. Mir Rowshan Akter, Associate Professor, Department of Microbiology, Hajee Mohammad Danesh Science & Technology University, Dinajpur	HSTU	Livestock
50	444	Effect of Different Fruit Bagging Materials on the Production of Quality and Safe Mango	Dr. Md. Tariqul Islam, Associate professor, Department of Horticulture, Hajee Mohammad Danesh Science and Technology University, Dinajpur	HSTU	Crops
51	448	Monitoring and surveillance of duck diseases in Hakaluki and Tanguar hoar and development of suitable vaccination models and other preventive strategies	Dr. Md. Shafiqul Islam, Assistant Professor, Department of Pathology and Parasitology, CVASU, Chittagong	CVASU	Livestock
52	451	Molecular identification of the tomato leaf curl virus (ToLCV) resistant/ tolerant tomato lines	Professor Dr. Mohammad Nurul Islam, Plant Breeding and Biotechnology lab, Department of Botany, University of Dhaka, Dhaka	Dhaka University	Crops
53	452	Effectiveness of non-chlorine sanitizers in improving the safety and quality of high value exportable fresh betel leaf	Md. Latiful Bari, Ph.D. Principal Scientist & Head, Food Analysis and Research Laboratory, Center for advanced Research in Sciences, University of Dhaka	Dhaka University	Crops
157	454	Agricultural Practices and livelihood Patterns of Selected Tribal Communities in Bangladesh	Dr. Jasim Uddin Ahmed, Associate Professor & Head, Dept. of Agricultural Economics and Policy, SAU, Sylhet	SAU, Sylhet	AERS
55	459	Selection of Salt Tolerant Sunflower and Mustard Genotypes Based on Physiological and Biochemical Traits	Dr. Md. Shakhawat Hossain, Senior Scientific Officer, Central Laboratory, Oilseed Research Centre, BARI, Gazipur	BARI	Crops
56	462	Study on environmental and socio-economic impact of Daudkandi model floodplain fisheries management	Md. Alam Hossain, Sustainable Development Associates, 180/6/12A, 1st Floor, Titas Road (near water pump), East Rampura, Dhaka	Sustainable Development Associates (SDA)	Fisheries
57	464	Production of Asian Seabass (Lates calcarifer) in brackish and freshwater earthen pond under natural and artificial feeding regime in South-west Coastal zone of Bangladesh	Dr. Muhammad Abdur Razzak Assistant Professor, Dept. of Marine Fisheries and Oceanography, Patuakhali Science and Technology University	PSTU	Fisheries

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58	465	Validation and up scaling of fresh cut fruits and vegetables processing technologies	Dr. Taslima Ayesha Aktar Nasrin, SSO, Postharvest Technology Section, Horticulture Research Centre, BARI, Joydebpur, Gazipur	BARI	Crops
59	471	DNA Barcoding of Freshwater Fishes of Bangladesh: Implication for Conservation and Management	Dr. Md. Sagir Ahmed. Professor, University of Dhaka, Dhaka.	Dhaka University	Fisheries
60	473	Develop a hydrogeological framework and a sustainable crop establishment period for haor areas of Bangladesh	Dr. Sanjida Parveen Ritu, Professor, Sylhet Agricultural University, Sylhet	SAU, Sylhet	Agril. Eng.
61	474	Status of insect biodiversity and ecosystem functions in tea estates of the Sylhet region	Dr. Md. Abdul Maleque, Associate Professor and Chairman, Department of Entomology, Faculty of Agriculture, Sylhet Agricultural University, Sylhet	SAU, Sylhet	Crops
62	477	Survey, Monitoring and Eco-friendly Integrated Management of Major Insect Pest and Disease in Chilli at Jamalpur Region	Dr. Md. Abdul Mannan, Principle Scientific Officer, Pathology Division, RARS, BARI, Jamalpur	BARI	Crops
63	479	Collection, Evaluation, Characterization and Bulb Preservation of Lilium in Bangladesh	Dr. Farjana Nasrin Khan SSO, Floriculture Division Horticulture Research Centre, BARI, Joydebpur, Gazipur	BARI	Crops
64	484	Management of Indigenous Fishes in Wetland (Gajner Beel, Pabna) Ecosystem	Dr. Md. Yeamin Hossain, Associate Professor, Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi	Rajshahi University	Fisheries
65	488	Mass seed production and culture technology of threatened fish Cirrhinus reba for sustainable aquaculture in Bangladesh	Dr. Imran Parvez, Associate Professor and Chairman, Department of Biology and Genetics, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur	HSTU	Fisheries
66	489	Development of Quality Value Added Fish Products and Utilization of By-products	Dr. Md. Abu Sayeed, Associate Professor, Sylhet Agricultural University, Sylhet	SAU, Sylhet	Fisheries
67	490	Crop Productivity Enhancement through Agronomic Practices in Sylhet Region	Dr. Dilwar Ahmed Choudhury PSO, BARI, Gazipur	BARI	Crops
68	491	Improving the performance of mechanized seeding through innovations in seed metering system	Dr. Md. Abdul Matin SSO, BARI, Gazipur	BARI	Agril. Eng.
69	492	Conservation Agricultural Practices for the Improvement of Soil Health, Cropping System Productivity and Farmers' Income	Nazmus Salahin Scientific Officer, BARI, Gazipur	BARI	Soil

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70	493	Characterization of commercial probiotics using for fish and shrimp culture in Bangladesh	Dr. S. M. Rafiquzzaman, Associate Professor, BSMRAU, Gazipur	BSMRAU	Fisheries
71	497	Evaluation of the suitability and efficacy of potato and wheat as prebiotic compounds on the growth performance, survaivality and tissue composition of Labeo rohita and Catla catla	Professor Md. Sazzad Hossain, Department of Aquaculture, Faculty of Fisheries, Bangladesh Agricultural University (BAU), Mymensingh	BAU	Fisheries
72	499	Nutrient management for a rooftop garden	Ibne Saleh Md. Farhad Scientific Officer, BARI, Gazipur	BARI	Soil
73	502	Molecular identification of local and exotic strains of koi (Anabas testudineus) for strategic conservation management	Dr. Mohammad Shafiqul Alam, Assistant Professor, Department of Genetics and Fish Breeding, Faculty of Fisheries, BSMRAU, Gazipur	BSMRAU	Fisheries
74	504	Risk Assessment and Development of Management Approach(Es) Against Tomato Leaf Miner, Tuta Absoluta	Dr. Md. Shahadath Hossain, SSO, Entomology Section, Horticulture Research Center, BARI, Gazipur.	BARI	Crops
75	510	Development of nanomaterial mediated feed for improving growth and immunity of fishes	Dr. Md. Jahangir Alam, Associate Professor, Department of Agronomy & Agricultural Extension, Rajshahi University, Rajshahi	Rajshahi University	Fisheries
76	512	Development of a sustainable agricultural risk management technology in areas affected by flash flood using numerical climate modeling data analysis	Dr. Md. Altaf Hossain, Associate Professor, Sylhet Agricultural University, Sylhet	SAU, Sylhet	P & E
77	518	Identification of different species of bacteria causing bacterial diseases of silkworm (Bombyxmori) L. and their control	Md.Aftabuddin, Research Officer, Bangladesh Sericulture Research and Training Institute, Baliapukur, Padma Abasik, Rajshahi	BSRTI	Crops
78	519	Development of modern reeling machineand its use for quality and quantity raw silk production in the field	Md.Abdul Alim Research Officer, BBSRTI, Baliapukur, Padma Abasik, Rajshahi	BSRTI	Agril. Eng.
79	520	Study on the nutritional quality of underutilized mulberry fruits, leaves & silkworm pupae and their value addition	Md. Shakhawat Hossain Research Officer, Bangladesh Sriculture Research and Training Institute, Baliapukur, Padma Abasik, Rajshahi	BSRTI	Nutrition
80	521	The future solutions for organic vegetables production in urban area	Dr. Md. Fuad Mondal, Assistant Professor, Sylhet Agricultural University, Sylhet	SAU, Sylhet	Nutrition
81	526	Studies on the Species Complex and Their Bio-Rational Based Management of Fruit Flies Infesting Fruits and Vegetables in Bangladesh	Dr.Syed NurulAlam, CSO & Head, Entomology Division, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur	BARI	Crops

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82	528	Upscaling of Lac Production Technologies for Poverty Reduction of the Ultra Poor and Marginal Farmers	Dr. Debashis Sarker, PSO, Entomology Division, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur	BARI	Crops
83	529	Determination of adulteration of commonly used pesticides and their left over residue in major fruits and vegetables	Dr. Md. Sultan Ahmed, Principal Scientific Officer, Entomology Division, BARI, Gazipur	BARI	Crops
84	532	Development of commercially feasible probiotic food products for human and feed products for poultry using native isolates through biotechnological interventions	Dr. Khondoker Moazzem Hoisain Professor, Khulna University, Khulna	Khulna University	Nutrition
85	533	Establishment of suitable fracture management techniques in different animals (cattle, goat, dog, cat) at Sahidul Alam Quadery Teaching Veterinary Hospital (SAQTVH) in Chittagong	Dr. Bhajan Chandra Das, Professor, CVASU, Khulshi, Chittagong	CVASU	Livestock
86	538	Development of production package with special emphasis on off season flowering of dragon fruit	Kbd. Dr. Md. Moshiur Rahmann SSO, Regional Horticulture Research Station, BARI, Sibpur, Narsingdi.	BARI	Crops
87	545	Effect of Nitrogen, Phosphorus and Potassium on Growth, Yield and Leaf Quality of Mulberry	Faruque Ahmed Research Officer, Bangladesh Sericulture Research and Training Institute, Rajshahi	BSRTI	Soil
88	548	Design and development of a compensatedemitter for efficient drip irrigation system in Bangladesh	Dr. Md. Moinul Hosain Oliver, Associate Professor, BSMRAU, Gazipur	BSMRAU	Agril. Eng.
89	551	Identification and economic analysis of existing agroforestry practices in the northern region of Bangladesh for better agroforestry practices	Dr. Md. Shoaibur Rahman Associate Professor, HSTU, Dinajpur	HSTU	Forest
90	553	Performance of induce breeding of threatened small indigenous species (*Botia Dario and Lepidocephalichthys guntea*)with different stimulate hormones	Dr. Shyamal Kumar Paul, Assistant Professor, Dept. of Fisheries and Marine Science, Noakhali Science and Technology University, Noakhali	NSTU	Fisheries
91	554	Agricultural Imaging System for Rice and Mungbean Disease Detection and Management in Agro-Field	Dr.S.M. Taohidul Islam, Associate Professor, PSTU ,Patuakhali	PSTU	P & E
92	556	Development and evaluation of formalin killed inactivated egg drop syndrome virus vaccine using local isolates	Dr. Marzia Rahman, Professor, BAU, Mymensingh	BAU	Livestock

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93	557	Benchmarking cost of milk production in typical dairy farms in selected regions of Bangladesh: Implications for milk market price and livelihood improvement policy	Dr. Mohammad Mohi Uddin Assistant Professor, Department of Animal Nutrition, BAU, Mymensingh	BAU	Livestock
94	559	Symbiotic and molecular characterization of potential saline tolerant rhizobial strains and bio-fertilizer production for soybean and groundnut	Dr. Faridul Alam, SSO, Soil Microbiology Laboratory, Soil Science Division, BARI, Joydebpur, Gazipur	BARI	Soil
95	570	Improving crop yield by using polythene mulch and potassium fertilization in saline soils	Dr. Mohammad Asadul Haque Professor, Department of Soil Science, PSTU, Dumki, Patuakhali	PSTU	Soil
96	576	Design and Development of Power Operated Oil Palm Fruit Stripper	Dr. Md. Abdul Awal Professor, Department of Farm Power and Machinery, BAU, Mymensingh	BAU	Agril. Eng.
97	582	Development of agroforestry model for conversion of rice–cotton based hill farming system in the Chittagong hill tracts	Mong Sanue Marma, Senior Scientific Officer, Hill Cotton Research Station, Cotton Development Board, Balaghata, Bandarban	CDB	Forest
98	583	Testing of cotton cultivation technology in the drought prone area of Barind Tract of Bangladesh	Md. Rezaul Amin, PSO, Cotton Research Center, Cotton Development Board, Rangpur	CDB	Crops
99	584	Eco-friendly Management of Sucking insects of Cotton	Md. Akhteruzzaman, Addition Director (Res. & Extn.), Cotton Development Board, Khamarbari, Farmgate, Dhaka	CDB	Crops
100	587	Impact of aquaculture on agricultural production in greater Noakhali districts	Dr. Md. Jahangir Sarker, Associate Professor, NSTU, Noakhali	NSTU	Fisheries
44	593	Development of a business model on crops and cattle for low carbon farming technique: An initiative for farm level in coastal region of Bangladesh	Dr. Fakir Azmal Huda Professor, Department of Agricultural Economics BAU, Mymensingh	BAU	AERS
102	595	Up-scaling of Multistory Agroforestry System for Diversified Production, High Income and Ecosystem Services	Dr. Md. Abiar Rahman, Professor, BSMRAU, Gazipur	BSMRAU	Forest
103	596	Rice-based agroforestry in Bangladesh – status and opportunities for sustainable land use system and combating future climate change challenges	Tofayel Ahamed, Professor, Department of Agroforestry and Environment, BSMRAU, Gazipur	BSMRAU	Forest
104	599	Collection and molecular characterization of resurged phytopathogen Sclerotinia sclerotiorum causing white mold disease of different crops and its integrated management	Dr. Md. Muzahid-E-Rahman Senior Scientific Officer, Plant Pathology Division, Bangladesh Agriculture Research Institute, Joydebpur, Gazipur	BARI	Crops

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105	601	Molecular characterization and integrated management of Cucumber mosaic virus infecting Cucumber (Cucumis sativus) in Bangladesh	Dr. Mohammad Siddiqur Rahman SSO (Plant Pathology), Plant Pathology Division, BARI, Joydebpur, Gazipur	BARI	Crops
106	603	Substantial development of genetic potential for improved productivity in cattle through manipulative reproduction technology	Dr. Nasrin Sultana Juyena Professor, Department of Surgery and Obstetrics, BAU, Mymensingh	BAU	Livestock
107	605	Standardization of Trichoderma fortified compost for growth promotion and Eco-friendly management of Tomato diseases	Dr. Md. Khurshed Alam Bhuiyan, Professor, Dept. of Plant Pathology, BSMRAU, Gazipur	BSMRAU	Crops
108	607	Mining nobel probiotics from Red Junglefowl (*Gallus gallus*) as the alternatives to antibiotics for the safe poultry production	Dr. Mueena Jahan Assistant Professor, BSMRAU, Gazipur	BSMRAU	Livestock
109	609	DNA barcoding and metabarcoding of coral associated fish and zooplankton community of Saint Martin's Island for effective conservation of marine life	Dr. Kazi Ahsan Habib Professor, Sher-e-Bangla Agricultural University Sher-e-Bangla Nagar, Dhaka	SAU, Dhaka	Fisheries
110	612	Enhancing Agricultural Research Information Services through digitization of research outputs	Md. Rafique Mostafa Kamal, Director (Addl. Charge), Agricultural Information Centre, BARC, New Airport Road, Farmgate, Dhaka	BARC	P & E
111	613	Distribution, severity, species diversity and damage assessment of papaya mealybug	Dr. Mst Nur Mohal Akhter Banu Associate professor, Dept of Entomology, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka	SAU, Dhaka	Crops
112	623	Rooftop Gardening: An Initiative to Spread Urban Horticulture with Changing Environment	Dr. Mohammad Mahbub Islam, Professor, Department of Agricultural Botany, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka	SAU, Dhaka	Crops
113	624	Developing a model-based water management plan for haor wetlands of Bangladesh to reduce the vulnerability of Boro rice crop to flash floods	Mohammed Mizanur Rahman Associate Professor, Department of Irrigation and Water Management, BAU, Mymensingh	BAU	Agril. Eng.
114	629	Development and upgradation of digital contents of National Agricultural Display Center (NADC) at BARC	Dr. Md. Baktear Hossain, Director (Additional Charge) Computer and GIS Unit, BARC, Farmgate, Dhaka	BARC	P & E
115	633	Innovation of flashflood coping rice technology for haor area through participatory approach	Dr. Mohammad Ashraful Islam, Associate Professor, Department of Agricultural Extension Education, Faculty of Agriculture, Sylhet Agricultural University	SAU, Sylhet	Crops

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116	638	Qualitative assessment of bottled drinking water and evaluation of pesticides residue of raw, washed and cooked vegetables	Dr. Md. Monirul Islam Director (Nutrition), BARC, Farmgate, Dhaka	BARC	Nutrition
117	647	Floating bed fodder cultivation in submerged and flooded areas in Sylhet District: A tool for climate resilient livestock production	Dr. Mohammad Mehedi Hasan Khan Professor and Chairman, Department of Biochemistry and Chemistry, Dean Faculty of Biotechnology and Genetic Engineering, Sylhet Agricultural University, Sylhet	SAU, Sylhet	Livestock
118	648	Potentials of modernization in fisheries sector of Bangladesh: Study on the peoples' profile, technologies and policies	Dr. Md. Tariqul Alam Associate Professor, Department of Aquaculture, Sylhet Agricultural University Sylhet	SAU, Sylhet	Fisheries
54	649	Economics of Adoption of Bio-security Measures for Controlling Avian Influenza in Bangladesh`s Poultry Farms	Dr. Ismat Ara Begum Professor, BAU, Mymensingh	BAU	AERS
120	654	Small scale farming of guineafowls and turkeys in Bangladesh- a tool for poverty reduction	Dr. Shubash Chandra DasProfessor, Department of Poultry Science, BAU, Mymensingh	BAU	Livestock
121	656	Enhancing the crop productivity through adoption of climate smart technologies in the salinity area of Bangladesh	Dr. Md. Abdul Kader, Professor, Department of Agronomy, Bangladesh Agricultural University, Mymensingh	BAU	Crops
122	659	Assessment of the impact of climate change on arthropodvectorsthose transmitting vector borne diseases in Bangladesh	Dr. Thahsin Farjana Professor, Department of Parasitology, Faculty of Veterinary Science, BAU, Mymensingh	BAU	Livestock
123	661	Development of low-cost technolory for making processed cheese	Dr. Raihan Habib Professor, Department of Dairy Science Faculty of Animal Husbandry, BAU, Mymensingh	BAU	Livestock
124	666	Updating of Fertilizer Recommendation through Interpretation of Research Results Generated by the NARS Institutes	Dr. Md. Abdus Satter CSO (Soils), Bangladesh Agricultural Research Council, Farmgate, Dhaka	BARC	Soil
125	668	Development of Protective Cultivation Techniques of Gladiolus and Gerbera in Bangladesh	Dr. Kabita Anzu- Man- Ara PSO, Floriculture Division, HRC BARI, Joydebpur, Gazipur	BARI	Crops
126	670	Identification of Major Insect and Mite Pests of Major Vegetables in Bangladesh and their Eco-friendly Management	Dr. Md. Mizanur Rahman Professor, Department of Entomology Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka	SAU, Dhaka	Crops

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127	672	Productivity Enhancement through Adaptation of Improved CropProduction Technologies in Previous Enclaves of Northern Region of Bangladesh	Dr. Md. Samim Hossain Molla, Senior Scientific Officer, On-Farm Research Division, Bangladesh Agricultural Research Institute, Rangpur	BARI	Crops
128	674	Production and Productivity Improvement of Haor Floodplain Fisheries for Upliftment of Fishers' Livelihood	Dr. Nirmal Chandra Roy Associate Professor, Sylhet Agricultural University, Sylhet	SAU, Sylhet	Fisheries
129	688	Improved Crops Productivity of Beel Areas of Bangladesh	Dr. Md. Abul Khayer Mian, PSO, Agronomy Division, Joydebpur, Gazipur	BARI	P & E
130	690	Assessing and mitigating the contamination of vegetable crops and soil under irrigation with urban wastewater	Dr. Sujit Kumar Biswas, Senior Scientific Officer, IWM Division, BARI, Gazipur	BARI	Soil
131	694	Assessment of effectiveness of avian influenza vaccination in commercial layer birds in Bangladesh	Dr. M. Arifur Islam, Dept. of Medicine, Professor, BAU, Mymensingh	BAU	Livestock
132	695	Quantitative analysis for the toxic chemical residues in fruits and vegetables using chromatographic techniques of selected markets in Bangladesh	Dr. Md. Azharul Islam Associate Professor, Department of Environmental Science, Bangladesh Agricultural University, Mymensingh	BAU	Crops
133	696	Improvement of Water Productivity for enhancing crop production in water scare area of North-West Bangladesh	Dr. Shahana Parveen, Senior Scientific Officer, Irrigation and Water Management division, BRRI, Gazipur	BRRI	Agril. Eng.
134	697	Intensification of Conservation Farming in North West Bangladesh	Dr. Md. Harun-Ar-Rashid, Senior Scientific Officer, Bangladesh Rice Research Institute, Regional Station, Rajshahi	BRRI	Soil
135	698	Identification of climatic factors responsible for disease and insect outbreak and their appropriate management in southern region of Barisal	Dr. M. Alamgir Hossain, Chief Scientific Officer. Bangladesh Rice Research Institute, Regional Station, Sagordi, Barisal	BRRI	Crops
101	700	Value Chain Analysis of Rice and its Byproducts in Bangladesh	Md. Imran Omar, SSO, BRRI, Gazipur	BRRI	AERS
137	701	Characterization of Important Rice Germplasm of Bangladesh	Dr. Mohammad Zahidul Isalm, Scientific Officer, Genetic Resources and Seed Division, BRRI, Gazipur	BRRI	Crops
138	705	Improvement and validation of BRRI developed headfeed mini combine harvester	Bidhan Chandra Nath SSO, BRRI, Gazipur	BRRI	Agril. Eng.
139	706	Delineating rice yield limiting soil factors for some selected paddy soils of Bangladesh	Dr. Mosud Iqbal, SSO, BRRI, Gazipur	BRRI	Soil

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140	707	Up-scaling of biofertilizer for improvement of soil health and rice yield in Bangladesh	Dr. Umme Aminun Naher, PSO, BRRI, Gazipur	BRRI	Soil
141	708	Combating seedling blight and raising healthy seedling/seed germination in cold environment	Dr. Tahmid Hossain Ansari, PSO, Plant Pathology Division, BRRI, Gazipur	BRRI	Crops
142	712	Identify and formulate biopesticides to control bakanae pathogen	Dr. Quazi Shireen Akhter Jahan Principal Scientific Officer, Plant Pathology Division, BRRI, Gazipur	BRRI	Crops
143	714	Introgression of heat tolerant QTL (qHTSF4.1) into Bangladeshi mega rice varieties through marker-assisted breeding	Dr. Munnujan Khanam Principal Scientific Officer (PSO), Plant Physiology Division, BRRI, Gazipur	BRRI	Crops
144	715	Enhancing Agricultural Technology through ICT Innovation: Mobile Application and Rice Database Development	Dr. Md Ismail Hossain, PSO, BRRI, Gazipur	BRRI	P & E
145	716	Up Scaling of BRRI Released New Promising Rice Varieties through Quality Seed Production at Farmers' Level	Dr. Md. Shafiqul Islam Mamin, CSO,Adaptive Research Division (ARD), BRRI, Gazipur	BRRI	Crops
146	718	Study of the climate change impact on fisheries resources and fishers' especially women and children in selected climate hotspot zone of Bangladesh	Dr. Zakir HossainProfessor, Department of Fisheries Biology and Genetics, BAU, Mymensingh	BAU	Fisheries
147	719	Production of low cholesterol healthy mutton by using natural herbs	Dr. Mohammad Al-Mamun Professor , Dept. of Animal Nutrition, BAU, Mymensingh	BAU	Nutrition
148	722	A field study on survivability of vitrified embryos in Bangladeshi native sheep	Dr. Farida Yeasmin Bari Professor, BAU, Mymensingh	BAU	Livestock
149	728	Development of shelf stable value added products from onion, garlic and ginger	Dr. Md. Masud Alam, SSO, SRC, BARI, Shibganj, Bogra	BARI	Agril. Eng.
150	729	Integrated rodent management in wheat and rice through ecofriendly control tehcniques	Dr. ATM Hasanuzzaman, SSO, Vertebrate Pest Division, BARI	BARI	Crops
151	730	Development of propagation and processing technology for Bay leaf andCinnamon	Dr. Shailendra Nath Mozumder, Senior Scientific Officer, Regional Spices Research Centre, BARI, Joydebpur, Gazipur	BARI	Crops
152	732	Validation of Integrated Pest Management (IPM) technologies in the farmers fields against major insect pests of soybean at Noakhali region	Dr. Gobinda Chandra Biswas, Principal Scientific Officer, Oilseed Research Centre, BARI, Joydebpur, Gazipur	BARI	Crops

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153	735	Production of compost, vermicompost and tricho-compost from household solid waste and their utilization on tomato and cabbage production	Dr. Ranjit Sen, SSO, BARI, Gazipur	BARI	Soil
154	744	Production and Field Release of Parasitoids and Predators for Management of Major Insect Pest of Sugarcrop	Md. Elmur Reza Scientific Officer, Entomology Division, BSRI, Ishurdi, Pabna	BSRI	Crops
155	746	Screening of sugarcane clones based on adaptive mechanisms under drought and salinity stress due to climatic change	Dr. M. Kohinoor Begum, PSO, BSRI, Ishurdi, Pabna	BSRI	P & E
156	748	Design and Development of Efficient and Low Cost Sugarcane Power Crusher for Goor Production	Sayed Shams Tabriz, Senior SO, BSRI, Ishurdi, Pabna	BSRI	Agril. Eng.
119	750	Cost and Return Analysis of Sugarcane Production with Intercrops in Bangladesh	Dr. Sayeeda Khatun PSO (cc), Agricultural Economics Division, BSRI, Ishurdi, Pabna	BSRI	AERS
158	753	Induction of somaclonal variation in non-flowering germplasm of sugarcane through in vitro culture	A. M. Sajedur Rahman, SO, Breeding Division, BSRI, Ishurdi, Pabna	BSRI	Crops
159	754	Innovation of dyed jute knitted fabric in textile technical sectors	Dr. Nazmina Chowdhury, CSO (RW), Pilot Plant & Processing Division, BJRI, Dhaka-1207.	BJRI	Agril. Eng.
160	755	Enhancement of Productivity of Kenaf in Char Areas	Dr. Md. Abul Fazal Mollah PSO, BSRI, Regional Station, Rangpur	BJRI	Crops
161	765	Selection of super high-yielding rice genotypes	Dr. A. S. M. Masuduzzaman CSO, BRRI, Gazipur	BRRI	Crops
162	767	Screening of Shattering Tolerance of *Brassica napus*	Dr. Md. Mubarak Ali PSO, Oilseed Research Centre , BARI, Gazipur	BARI	Crops
163	768	Incretion of Crop Productionby Utilization of Fallow Land through Underutilized Crops in Coastal Saline Area of Noakh	Dr. Md. Aminur Rahman SSO, On-Farm Research Division, BARI, Maijdee Bazar, Noakhali	BARI	Crops
164	769	Development of mobile phone applications for phenotyping and assessment of nitrogen fertilizer requirement by digital image analysis in cereal crops	Shamim Ara Begum, SSO, Seed Technology Division, BARI, Gazipur, Dhaka	BARI	P & E
165	774	Development of a low cost battery operated rotary type upland weeder	Dr. Md. Israil Hossain CSO (Agril. Engineering) Farm Machinery and Postharvest Process Engineering Division BARI, Joydebpur, Gazipur	BARI	Agril. Eng.

Sl No.	Project ID	Sub-Project Title	Name of the PI and address	Institute	Division/ Unit
166	777	Improvement of dry direct seeded boro rice based cropping pattern through climate smart technologies and its adoption in drought-prone areas	Dr. Md. Moshiur Rahman, Professor, Department of Agronomy, Bangladesh Agricultural University, Mymensingh	BAU	Crops
167	778	Fine tuning of short cycle culture of shrimp Penaeus monodon in rotation with tilapia in the coastal ghers	Syed Lutfor Rahman, CSO, Bangladesh Fisheries Research Institute, Brackish Water Station, Paikgacha, Khulna	BFRI (Fisheries)	Fisheries
168	779	Improvement of live feed culture for Brackishwater hatchery operation	Nilufa Begum SSO, BFRI, Paikgacha, Khulna	BFRI (Fisheries)	Fisheries
169	780	Design and Development of Jute-Cotton Reinforced Polimer Composite for Rural Poultry Housing	Md. Moslem Uddin, PSO, Textile Physics Division, BJRI, Dhaka-1207.	BJRI	Agril. Eng.
170	781	Assessment of methane emission in dairy production systems based on existing feed resources through GLEAM model under different climatic zones of Bangladesh and their mitigation options	Dr. N.R. Sarker, PSO, Bangladesh Livestock Research Institute, Savar, Dhaka	BLRI	Livestock
171	783	Collection, Conservation and Maintenance of Different Fruits Germplasm in the Hilly Region of Bangladesh	Md. Golam Rahman, Scientific Officer, Hill Agricultural Research Station (HARS), Khagrachari Hill Tracts	BARI	Crops
172	785	Study on bionomics, Species diversity/host range, management technique of mealybug in kenaf and mesta	Dr, Md. Nazrul Islam, Principal Scientific Officer, Entomology Department, Bangladesh Jute Research Institute.	BJRI	Crops
173	787	Offline Fertilizer Recommendation through Mobile Apps	Dr. Mohiuddin Ahmed, PSO, SRDI.	SRDI	P & E
174	788	Development of cost effective complete pelleted feed and its utilization for commercial goat and sheep production	Dr. Sadek Ahmed, Senior Scientific Officer, BLRI, Savar, Dhaka	BLRI	Livestock
175	790	Development of probiotic feed suppliment for calves	Dr. Sardar Muhammad Amanullah, SSO, Biotechnology Division, BLRI, Savar, Dhaka.	BLRI	Livestock
176	791	Effect of variety and fertilizer on cotton yield, fiber quality and seed oil content.	Khalequzzaman, SSO, Cotton Development Board, Khamarbari, Farmgate, Dhaka	CDB	Soil
177	798	Heavy Metal in the Industrial Polluted Area: Spatial Distribution, Risk Assessment and Bacterial Biogeography of Contaminated Soils	Dr. M. Saiful Alam Associate Professor, BSMRAU, Gazipur	BSMRAU	Soil
178	801	Assessment of land degradation situation for improving soil quality and crop productivity using nuclear techniques	Dr. Md. Mahbubul Alam Tarafder SSO, Soil Science Division, BINA, Mymensingh	BINA	Soil

Sl No.	Project ID	Sub-Project Title	Name of the PI and address	Institute	Division/ Unit
179	802	Studies on the performance of vermicompost and organic materials for improving soil fertility and crop productivity	Dr. Md. Azizul Haque PSO, BINA, Mymensingh	BINA	Soil
180	804	Improvement of spices varieties cumin, sweet pepper, chilli, turmeric and black pepper through induced mutation	Dr. Md. Rafiqul Islam SSO & Head, Horticulture Division, Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh	BINA	Crops
181	809	Oxidative stress tolerance of wheat under drought and salinity: Mechanism and identification of stress inducible proteins	Dr. Md. Moshiul Islam, Associate Professor and Head, Dept of Agronomy, Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur	BSMRAU	Crops
182	811	Development and Dissemination of Fertilizer Deep Placement Applicator for Increasing Fertilizer Use Efficiency and Farm Productivity	Dr. Md. Abdul Wohab, CSO, RARS, BARI, Rahmatpur, Barisal	BARI	Agril. Eng.
183	814	Development and Adaptation of Water Saving Irrigation Techniques for Upland Crops	Dr. K. K. Sarker, Scientific Officer, BARI, Gazipur	BARI	Agril. Eng.
184	815	Studies on gummosis of shade trees in tea plantation and its management	Dr. M. Ahsanur Rahman Senior Research Officer, BFRI, Chittagong	BFRI (Forest)	Forest
185	817	Biochemical and molecular assay for Detection of Vibrio spp at Shrimp and Shrimp Farms in Bangladesh	Muhammad Shahdat Hossaain, SO, Fisheries Biotechnology Division, Ganakbari, Ashulia, Savar, Dhaka	NIB	Fisheries
186	820	DNA barcoding of common native livestock & poultry and crossbreed animals in Bangladesh: potential uses in conservation for increasing production	Dr. Md. Abdul Alim Senior Scientific Officer, NIB, Ganakbari, Ashulia, Savar, Dhaka	NIB	Livestock
187	823	Residual Assessment of Hazardous Pesticides and Antibiotics in Shrimp/Prawn Farming Systems of South-West Bangladesh with its Traceability Identification and Risk Quantification on Human Health	Md. Ariful Islam Scientific Officer, Bangladesh Fisheries Research Institute, Shrimp Research Station, Bagerhat	BFRI (Fisheries)	Fisheries
188	825	Adoption of Culture Technologies of Short Cycle Fish Species in the Semi-arid Zone of Bangladesh	Dr. Khondaker Rashidul Hasan SSO and Sub-station Chief, FSS Bangladesh Fisheries Research Institute, Saidpur, Nilphamari	BFRI (Fisheries)	Fisheries
189	827	Development of Mixed Culture Technology of High Valued Galda (Macrobrachium rosenbergii) with Two Native Catfish, Shing (Heteropneustes fossilis) and Magur (Clarias batrachus) in South-western Coastal Ghers of Bangladesh	Dr. Khan Kamal Uddin Ahmed CSO, Shrimp Research Station, BFRI, Bagerhat	BFRI (Fisheries)	Fisheries
190	833	Production enhancement of carps and tilapia in creeks of Chittagong hill districts	Md. Abul Bashar Senior Scientific Officer, Revine Sub-station, BFRI, Rangamati	BFRI (Fisheries)	Fisheries

Annex-II: List of Awarded PBRG Sub-projects

Sl No.	Project ID	Title of the sub-project	Name of Coordinator and Principal Investigator	Position in the Sub-project	Total Budget (Tk.)
Agril. Eng. Unit					
1	001	Up-scaling and application of solar photovoltaic pump for smallholder irrigation and household appliances in the central coastal region of Bangladesh	Dr. Sultan Ahmmed Member Director (NRM), BARC, Farmgate, Dhaka	Coordinator	6668180
			Dr. Mohammed Ayub Hossain PSO, Farm Machinery and Postharvest Process Engineering Division, BARI, Gazipur	Principal Investigator	10769850
			Dr.A. B. M. Zahid Hossain SSO, Irrigation and Water Management Division, BRRI, Gazipur	Principal Investigator	10944490
				Sub-total	**28382520**
2	002	Groundwater resources management for sustainable crop production in northwest hydrological region of Bangladesh	Dr. Sultan Ahmmed Member Director (NRM), BARC, Farmgate, Dhaka	Coordinator	7774921
			Dr. Abeda Khatun CSO, Irrigation and Water Management Division, BARI, Joydebpur, Gazipur	Principal Investigator	11521880
			Dr. Md Towfiqul Islam PSO, & Head, Irrigation and Water Management Division, BRRI, Gazipur	Principal Investigator	10420025
			Dr. Md. Hossain Ali PSO & Head, Agricultural Engineering Division, BINA, Mymensingh	Principal Investigator	7563070
				Sub-total	**37279896**
3	064	Design and development of fertilizer deep placement mechanism for existing rice transplanter	Dr. Md. Ansar Ali Director (Administration and Common Service), BRRI, Gazipur	Coordinator	0
			Dr. Md. Anwar Hossen SSO, FMPHT Division , BRRI, Gazipur	Principal Investigator	9031737
			Dr. Md. Mozammel Haque SSO, Soil Science Division Bangladesh Rice Research Institute (BRRI), Gazipur	Principal Investigator	1968263
				Sub-total	**11000000**
Forest Unit					
4	049	Adaptation and scaling up agroforestry for livelihood improvement of farmers in agricultural ecosystem of Bangladesh	Dr. ASM Mahbubur Rahman Khan CSO, On-Farm Research Division, BARI, Gazipur	Coordinator	7766000
			Dr. Madan Gopal Saha Chief Scientific Officer, Pomology Division, HRC, BARI, Gazipur	Principal Investigator	2234000
				Sub-total	**10000000**

Sl No.	Project ID	Title of the sub-project	Name of Coordinator and Principal Investigator	Position in the Sub-project	Total Budget (Tk.)
5	072	Germplasm conservation and farm productivity enhancement through the interaction of shade trees and tea based agroforestry system to mitigate the climate change	Dr. Sultan Ahmmed Member Director (NRM), BARC, Farmgate, Dhaka	Coordinator	9311658
			Dr. A. F. M. Saiful Islam Professor, Dept. of Crop Botany and Tea Production, Sylhet Agricultural University (SAU), Sylhet	Principal Investigator	7810612
			Mr. Md. Ismail Hossain CSO, Crop Production Division, Bangladesh Tea Research Institute (BTRI), Sreemangal, Moulvibazar	Principal Investigator	6677730
				Sub-total	**23800000**
6	074	Identification, multiplication and ex-situ conservation of endangered forest genetic resources including medicinal plants of Bangladesh	Dr. Sultan Ahmmed Member Director (NRM), BARC, Farmgate, Dhaka	Coordinator	8267036
			Dr. Md. Habibur Rahman Professor, Department of Horticulture, BAU, Mymensingh	Principal Investigator	6577800
			Dr. Rafiqul Haidar Divisional Officer, Minor Forest Production Division, BFRI, Sholoshahar, Chittagong	Principal Investigator	7473270
			Dr. Mohammed Kamal Hossain Professor, Institute of Forest an Environmental Sciences, University of Chittagong, Chittagong	Principal Investigator	4843400
				Sub-total	**27161506**
7	077	Upliftment of farmers livelihood and enrichment of environment through improved agroforestry practices in char Land ecosystem of Bangladesh	Dr. Sultan Ahmmed Member Director (NRM), BARC, Farmgate, Dhaka	Coordinator	12115340
			Dr. G.M. Mujibur Rahman Professor, Department of Agroforestry, BAU, Mymensingh	Principal Investigator	6253226
			Dr. Mohammad Saidur Rahman SSO, Regional Agricultural Research Station, BARI, Jamalpur	Principal Investigator	7519050
			Dr. Hasneen Jahan Professor, Department of Agricultural Economics, BAU, Mymensingh	Principal Investigator	3122740
				Sub-total	**29010356**
Soil Unit					
8	134	Determination of critical limit of nutrients for soils and crops	Dr. Sultan Ahmmed Member Director (NRM), BARC, Farmgate, Dhaka	Coordinator	6225714

Sl No.	Project ID	Title of the sub-project	Name of Coordinator and Principal Investigator	Position in the Sub-project	Total Budget (Tk.)
			Dr. Nirmal Chandra Shil PSO, Soil Science Division, Bangladesh Agricultural Research Institute (BARI), Gazipur	Principal Investigator	7011920
			Dr. Aminul Islam PSO, Soil Science Division, BRRI, Gazipur	Principal Investigator	6863125
			Dr. Md. Habibur Rahman SSO, Soil Science Division, Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh	Principal Investigator	6252511
			Dr. Md. Anwarul Abedin Professor, Department of Soil Science, BAU, Mymensingh	Principal Investigator	6537840
				Sub-total	**32891110**
9	135	Improvement of soil health and crop productivity in climate vulnerable and polluted areas through organic amendments	Dr. Sultan Ahmmed Member Director (NRM), BARC, Farmgate, Dhaka	Coordinator	7173200
			Dr. Sohela Akhter PSO, Soil Science Division, BARI, Gazipur	Principal Investigator	6623650
			Dr. Umme Aminun Naher PSO, Soil Science Division, BRRI, Gazipur	Principal Investigator	5154693
			Dr. Md. Belal Hossain SSO, Soil Science Division, Bangladesh Institute of Nuclear Agriculture(BINA), Mymensingh	Principal Investigator	3736820
			Prof. Dr. Md. Mafizur Rahman Jahangir, Department of Soil Science, BAU, Mymensingh	Principal Investigator	4740140
			Dr. GKM Mustafizur Rahman Prof. Department of Soil Science, BSMRAU, Gazipur	Principal Investigator	6722403
			Prof. Dr. Alok Kumar Paul Department of Soil Science, SAU, Dhaka	Principal Investigator	2976000
				Sub-total	**37126906**
Crops Division					
10	005	Transfer of agricultural technologies to farmers' level for increasing farm productivity	Dr. S. M. Bokhtiar Director, TTMU, BARC, Farmgate, Dhaka	Coordinator	7900000
			Dr. A F M Feroj Hasan SSO and Head, Adaptive Research and Extension Division (ARED), BINA, Mymensingh	Principal Investigator	2300000
			Dr. Syed Md. Mizanur Rahman SSO, Pomology Division, Horticulture Research Centre, BARI, Gazipur	Principal Investigator	2500000

Sl No.	Project ID	Title of the sub-project	Name of Coordinator and Principal Investigator	Position in the Sub-project	Total Budget (Tk.)
			Dr. Md. Zillur Rahman SSO, Training, Planning and Technology Testing Division, BLRI, Savar, Dhaka	Principal Investigator	2300000
			Dr. Yahia Mahmud Director General, Bangladesh Fisheries Research Institute, Mymensingh	Principal Investigator	2800000
			Dr. Md. Abdul Hakim SSO, Wheat Breeding, BWMRI, Dinajpur	Principal Investigator	2100000
			Dr. Md. Nurul Kashem PSO & Head, Training and Technology Transfer Division, BSRI, Ishurdi, Pabna	Principal Investigator	2100000
			Md. Mominul Islam SSO, Cotton Development Board Khamarbari, Farmgate ,Dhaka	Principal Investigator	2500000
			Dr. Md. Ayub Khan CSO, Jute Farming Systems Division (JFSD), BJRI, Manik Miah Avenue, Dhaka	Principal Investigator	2800000
			Dr. Md. Humayun Kabir SSO, Adaptive Research Division, Bangladesh Rice Research Institute (BRRI), Gazipur	Principal Investigator	2550000
			Dr. Md. Altaf Hossain PSO, Soil & Land Classification Survey Section, SRDI, Dhaka	Principal Investigator	2610000
				Sub-total	**32460000**
11	010	DNA marker-assisted breeding for producing highly stress tolerant elite rice varieties for coastal Bangladesh by introgression of multiple salt tolerance loci (QTLs) into commercial cultivars	Dr. Tamal Lata Aditya Director (Research), BRRI, Joydebpur, Gazipur	Coordinator	0
			Dr. Md. Ruhul Amin SSO, Pant Breeding Division, BRRI, Joydebpur, Gazipur	Principal Investigator	5080156
			Dr.Zeba Islam Seraj Professor, Dept. of Biochemistry and Molecular Biology, University of Dhaka, Dhaka	Principal Investigator	9102919
				Sub-total	**14183075**
12	013	Development of lean season fruit varieties and management packages	Dr. Madan Gopal Saha CSO, Pomology Division, HRC, BARI, Gazipur	Coordinator	17848780
			Dr. Md. Iqbal Faruk Senior Scientific Officer Plant Pathology Division, BARI, Gazipur	Principal Investigator	1161120

Sl No.	Project ID	Title of the sub-project	Name of Coordinator and Principal Investigator	Position in the Sub-project	Total Budget (Tk.)
			Dr. Md. Kafil Uddin SSO, Entomology Division BARI, Gazipur	Principal Investigator	990100
				Sub-total	**20000000**
13	016	Integration of postharvest technologies and best practices in the value chains of fruits and vegetables	Dr. Md. Miaruddin CSO, Postharvest Technology Division, BARI, Joydebpur, Gazipur	Coordinator	1349040
			Dr. Md. Nazrul Islam PSO, Postharvest Technology Section, HRC, BARI, Gazipur	Principal Investigator	7443330
			Dr.Md. Nurul Amin SSO, Farm Machinery and Postharvest Process Engineering Division, BARI, Joydebpur, Gazipur	Principal Investigator	6294692
			Dr. Md. Latiful Bari Principal Scientist, Food Analysis and Research Laboratory, Center for Advanced Research in Sciences, University of Dhaka, Dhaka	Principal Investigator	3390701
				Sub-total	**18477763**
14	026	Development of integrated crop management technologies for higher production of coconut in Bangladesh	Dr. Md. Azmat Ullah CSO, Olericulture Division, Horticulture Research Center, BARI, Joydebpur, Gazipur	Coordinator	4700000
			Dr. Debasish Sarker PSO, Entomology Division, BARI, Joydebpur, Gazipur	Principal Investigator	3850000
			Dr. Md. Mynul Islam SSO, Plant Pathology Division, BARI, Joydebpur, Gazipur	Principal Investigator	1450000
			Dr. Md. Shafiqul Islam Head, Research and Development, SSURDA, Dhaka	Principal Investigator	3000000
				Sub-total	**13000000**
15	054	Introduction of profitable and agro-ecologically suitable crop varieties and development of marketing systems for the charlands of northern Bangladesh	Dr. A.S.M. Mahbubur Rahman Khan CSO, OFRD, BARI, Gazipur	Coordinator	892000
			Dr. Md. Mazharul Anwar PSO, Region-1, On-Farm Research Division, BARI, Rajshahi	Principal Investigator	5068296
			Dr. A.K.M. Zakir Hossain Professor & Head, Department of Crop Botany, Faculty of Agriculture, BAU, Mymensingh	Principal Investigator	4039704
				Sub-total	**10000000**
16	087	Eco-friendly rodent management through owl conservation	Dr. Md. Ansar Ali Director (Administration and Common Service), BRRI,	Coordinator	0

Sl No.	Project ID	Title of the sub-project	Name of Coordinator and Principal Investigator	Position in the Sub-project	Total Budget (Tk.)
			Gazipur		
			Dr. Md. Mofazzel Hossain PSO, Entomology Division, BRRI, Gazipur	Principal Investigator	10046451
			Dr. Md. Shah Alam PSO (In-Charge) and Head, Vertebrate Pest Division, BARI, Gazipur	Principal Investigator	7271124
				Sub-total	**17317575**
17	089	Establishment of profitable cropping pattern through crop intensification in underutilized unfavorable ecosystem	Dr. Md. Abul Kalam Azad CSO, Plant Breeding Division, BINA, Mymensingh	Coordinator	1800000
			Dr. Shamima Begum SSO, Adaptive Research and Extension Division, BINA, Mymensingh	Principal Investigator	11700000
			Md. Mohsin Ali Sarkar SSO, Agricultural Economics Division, BINA, Mymensingh	Principal Investigator	2500000
				Sub-total	**16000000**
18	091	Identification of novel resistant gene(s), gene pyramiding and sustainable management of bacterial blight (BB) disease of rice for ensuring food security	Dr. Md. Ansar Ali Director (Administration and Common Service), BRRI, Gazipur	Coordinator	0
			Dr. Md. Abdul Latif PSO and Head, Plant Pathology Division, Bangladesh Rice Research Institute (BRRI), Gazipur	Principal Investigator	10481120
			Dr. Md. Rashidul Islam Professor, Department of Plant Pathology, BAU, Mymensingh	Principal Investigator	4957032
				Sub-total	**15438152**
19	128	Collection and characterization of important plant genetic resources	Dr. Aziz Zilani Chowdhury Member Director (Crops), BARC, Farmgate, Dhaka	Coordinator	11694310
			Dr. Md. Nazirul Islam CSO (In-charge), Plant Genetic Resources Centre, BARI, Joydebpur, Gazipur	Principal Investigator	9500000
			Dr. Mohammad Khalequzzaman Chief Scientific Officer and Head,Genetic Resources and Seed Division, BRRI, Gazipur	Principal Investigator	5000000
			Mr. Md. Rafiqul Islam CSO (cc), Genetic Resources and Seed Division, BJRI, Manik Mia Avenue, Dhaka	Principal Investigator	1500000
			Dr. Md. Anisur Rahman PSO (c.c.), Breeding Division, Bangladesh Sugarcrop Research Institute, Ishurdi, Pabna	Principal Investigator	1999990

Sl No.	Project ID	Title of the sub-project	Name of Coordinator and Principal Investigator	Position in the Sub-project	Total Budget (Tk.)
			Dr. Mirza Mofazzal Islam CSO and Head, Plant Breeding Division, BINA, Mymensingh	Principal Investigator	3299920
			M M Abed Ali SSO, Cotton Research Farm, CDB,Jagadishpur, Jessore	Principal Investigator	1500000
			Faruque Ahmed Research Officer, Bangladesh Sericulture Research and Training Institute (BSRTI), Rajshahi	Principal Investigator	1500000
			Dr. M. A. Rahim Professor, Department of Horticulture, BAU, Mymensingh	Principal Investigator	2000000
				Sub-total	**37994220**
Livestock Division					
20	108	Development of knowledge hub on Animal Feed Resources for efficient feeding management of ruminants to enhance productivity	Dr. Shah Md. Ziqrul Haq Chowdhury Member Director (Livestock),BARC, Farm gate, Dhaka	Coordinator	1372300
			Dr. Nasrin Sultana, PSO & Head,Training, Planning and Technology Division, BLRI, Savar, Dhaka	Principal Investigator	7461996
			Dr. Mohammad Mohi Uddin, Assistant Professor, Department of Animal Nutrition, Faculty of Animal Husbandry, BAU, Mymensingh	Principal Investigator	4186475
			Dr. Md. Jasim Uddin Professor, Department of Animal Nutrition, Faculty of Veterinary, Animal and Biomedical Sciences, SAU, Sylhet	Principal Investigator	3911478
				Sub-total	**16932249**
21	110	Application of Gamma-ray Irradiation to develop stress tolerant capability in fodder crops and their production performance under on-station and on-farm conditions	Dr. Shah Md. Ziqrul Haq Chowdhury, Member Director (Livestock), BARC, Farm gate, Dhaka	Coordinator	700000
			Dr. Biplob Kumer Roy, Senior Scientific Officer, Animal Production Research Division, Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka	Principal Investigator	5858269
			Dr. Md. Imtiaz Uddin, Chief Scientific Officer & Head, Biotechnology Division, Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh	Principal Investigator	2760300

Sl No.	Project ID	Title of the sub-project	Name of Coordinator and Principal Investigator	Position in the Sub-project	Total Budget (Tk.)
				Sub-total	**9318569**
22	138	Determination of antimicrobial resistance and residues in livestock and poultry food products and feed in Bangladesh	Dr. Shah Md.Ziqrul Haq Chowdhury, MD (Livestock), BARC, Farmgate, Dhaka	Coordinator	4069021
			Dr. Kazi Rafiqul Islam Professor, Dept. of Pharmacology, BAU, Mymensingh	Principal Investigator	5839362
			Dr. Md. Giasuddin PSO, Bangladesh Livestock Research Institute, Savar, Dhaka	Principal Investigator	3240677
			Dr. K. M. Mozaffor Hossain Professor, Department of Veterinary and Animal Sciences, University of Rajshahi, Rajshahi	Principal Investigator	3045500
			Dr. Farzana Islam Rume Associate Professor, Department of Microbiology and Public Health, Faculty of Animal Science and Veterinary Medicine, PSTU, Babugonj, Barisal	Principal Investigator	3199120
			Dr. Sharmin Chowdhury Professor, Dept. of Pathology and Parasitology, Chittagong Veterinary and Animal Sciences University (CVASU), chittagong	Principal Investigator	4441960
			Dr. ATM Mahbub-E-Elahi Professor, Department of Microbiology and Immunology, Sylhet Agricultural University (SAU), Sylhet	Principal Investigator	3864750
			Dr. Md. Khaled Hossain Associate Professor, Dept. of Microbiology, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur	Principal Investigator	3268320
				Sub-total	**30968710**
23	139	Preparedness for the control of PPR in Bangladesh	Dr. Shah Md.Ziqrul Haq Chowdhury, Member Director (Livestock), BARC, Farmgate, Dhaka	Coordinator	5577200
			Dr. Md. Ershaduzzaman Director and PSO, Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka	Principal Investigator	8194162
			Prof. Dr. Abu Hadi Noor Ali Khan, Dept. of Pathology, Bangladesh Agricultural University (BAU), Mymensigh	Principal Investigator	5997470

Sl No.	Project ID	Title of the sub-project	Name of Coordinator and Principal Investigator	Position in the Sub-project	Total Budget (Tk.)
				Sub-total	**19768832**
Fisheries Division					
24	029	Adoption of innovative technology: Seed to fattening of mud crab (Scylla olivacea) and health management in Bangladesf condition	Dr. Khan Kamal Uddin Ahmed,Chief Scientific Officer, Shrimp Research Station, BFRI, Bagerhat	Coordinator	1120000
			Dr. Md. Monirul Islam Member Director (Fisheries), BARC, Farmgate, Dhaka	Principal Investigator	4855000
			Dr. Md. Latiful Islam SSO, Bangladesh Fisheries Research Institute, Brackish Water Station, Paikgacha, Khulna	Principal Investigator	12254768
			Dr.Abul Farah Md. Hasanuzzaman Associate Professor, Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna	Principal Investigator	8025000
				Sub-total	**26254768**
25	030	Investigation and characterization of viral and bacterial diseases in selected fin fish and shrimp in Bangladesh, vaccines development and validation	Member Director (Fisheries) Bangladesh Agricultural Research Council(BARC), Farmgate, Dhaka	Coordinator	4496500
			Fresh Water Station, Bangladesh Fisheries Research Institute (BFRI), Mymensingh	Principal Investigator	7654512
			Dr. Md. Alimul Islam Professor, Department of Microbiology and Hygiene, Faculty of Veterinary Science, BAU, Mymensingh	Principal Investigator	15723492
				Sub-total	**27874504**
26	031	Development of in-situ breeding technology of prawn (Macrobrachium rosenbergii) and adoption of sustainable ecofFriendly culture of prawn and shrimp (Penaeus monodon)	Dr. Mohammed Nurullah Director (Research and Planning) , Bangladesh Fisheries Research Institute (BFRI), Mymensingh	Coordinator	1153200
			Dr. Md. Monirul Islam Member Director (Fisheries), BARC, Farmgate, Dhaka	Principal Investigator	4159993
			Dr. Khan Kamal Uddin Ahmed,Chief Scientific Officer, Shrimp Research Station, BFRI, Bagerhat	Principal Investigator	14910000
			Dr. Khandaker Anisul Haq Professor, Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna	Principal Investigator	7540000
				Sub-total	**27763193**

Sl No.	Project ID	Title of the sub-project	Name of Coordinator and Principal Investigator	Position in the Sub-project	Total Budget (Tk.)
27	035	Techniques adoption and formulation of guidelines for sustainable management of Haor and Beel fisheries	Dr. Md. Monirul Islam Director (Nutrition), BARC, Farmgate, Dhaka	Coordinator	3628000
			Dr. Mrityunjoy Kunda Professor, Department of Aquatic Resource Management, Faculty of Fisheries, Sylhet Agricultural University (SAU), Sylhet	Principal Investigator	12000000
			Dr. Mushtaq Ahmed Professor, Department of Civil and Environmental Engineering, Shahjalal University of Science and Technology (SUST), Sylhet	Principal Investigator	6000000
			Dr. Md. Abu Sayed Jewel Associate Professor, Department of Fisheries, University of Rajshahi, Rajshahi	Principal Investigator	13372000
				Sub-total	**35000000**
28	036	Post-harvest losses, supply and value chain analysis of fisheries sub-sector in Bangladesh	Member Director (Fisheries) Bangladesh Agricultural Research Council (BARC), Farmgate, Dhaka	Coordinator	4358419
			Dr. Md. Akhtaruzzaman Khan,Professor, Department of Agricultural Finance, Bangladesh Agricultural University (BAU), Mymensingh	Principal Investigator	13812020
			Dr. Md. Mamun Or Rashid Professor, Department of Basic Science, Patuakhali Science and Technology University (PSTU), Dumki, Patuakhali	Principal Investigator	19533120
				Sub-total	**37703559**
29	037	Improvement of existing fattening technology of carp and high valued small indigenous species (SIS) through good aquaculture practices (GAP) in different agro-ecosystems	Member Director (Fisheries),Bangladesh Agricultural Research Council (BARC), Farmgate, Dhaka	Coordinator	4692858
			Dr. Md. Akhtar Hossain Professor, Dept. of Fisheries, University of Rajshahi, Rajshahi	Principal Investigator	20706230
			Md. Jahangir Alam Assistant Professor, Dept. of Fisheries Management, Patuakhali Science & Technology University (PSTU), Dumki, Patuakhali	Principal Investigator	12599524
				Sub-total	**37998612**
P & E Division					
30	061	Integrated farming research and development for livelihood improvement in the plain land eco-system	Dr. Paresh Chandra Golder Member Director(Planning & Evaluation), BARC, Farmgate, Dhaka	Coordinator	6300000

Sl No.	Project ID	Title of the sub-project	Name of Coordinator and Principal Investigator	Position in the Sub-project	Total Budget (Tk.)
			Dr. ASM Mahbubur Rahman Khan,CSO, OFRD, BARI, Joydebpur, Gazipur	Principal Investigator	16000000
			Dr. Abhijit Saha PSO, Rice Farming Systems Division, BRRI, Gazipur	Principal Investigator	6000000
			Md. Shahidul Islam SSO, BFRI, Mymensingh	Principal Investigator	8700000
				Sub-total	**37000000**
31	096	Improvement of farm productivity through intervention with improved agricultural technologies in char land eco-System	Dr. Paresh Chandra Golder Member Director,(Planning & Evaluation), BARC, Farmgate, Dhaka	Coordinator	10200000
			Dr. Md. Faruque Hossain SSO, On-Farm Research Division, BARI, Gazipur	Principal Investigator	10000000
			Dr. Md. Abdul Jalil PSO, Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka	Principal Investigator	5600000
			Dr. Md. Raisul Haider CSO & Research Coordinator, BINA, Mymensingh	Principal Investigator	5700000
			Dr. Md. Jahangir Alam PSO, Agronomy and Farming Systems Division, Bangladesh Sugarcrop Research Institute (BSRI), Ishurdi, Pabna	Principal Investigator	5500000
				Sub-total	**37000000**
32	098	Climate resilient farming systems research and development for the coastal ecosystem	Dr. Paresh Chandra Golder Member Director,(Planning & Evaluation), BARC, Farmgate, Dhaka	Coordinator	9800000
			Dr. M. Akkas Ali PSO, On-Farm Research Division, BARI, Joydebpur, Gazipur	Principal Investigator	13000000
			Dr. Mohammad Ibrahim PSO, Bangladesh Rice Research Institute, Regional Station, Binerpota, Satkhira	Principal Investigator	6600000
			Dr. Md. Munjurul Islam PSO & Head, Agronomy Division, BINA, Mymensingh	Principal Investigator	6600000
				Sub-total	**36000000**
AERS Division					
33	021	Cost and return analysis of selected crops in Bangladesh	Dr. A.S.M. Anwarul Huq Member Director (AERS), BARC, Farmgate, Dhaka	Coordinator	9606805
			Dr. Md. Abdur Rashid PSO, Agricultural Economics Division, BARI, Gazipur	Principal Investigator	11349542

Sl No.	Project ID	Title of the sub-project	Name of Coordinator and Principal Investigator	Position in the Sub-project	Total Budget (Tk.)
			Syful Islam SO, Agricultural Economics Division, BINA, Mymensingh	Principal Investigator	2243250
				Sub-total	**23199597**
34	070	Economic viability and production efficiency of rice at farm level: A macro level study in Bangladesh	Dr. Md. Ansar Ali Director (Administration and Common Service), BRRI, Gazipur	Coordinator	0
			Dr. Md. Abu Bakr Siddique CSO, Agricultural Economics Division, BRRI, Gazipur	Principal Investigator	15108720
			Dr. Md. Taj Uddin Professor, Department of Agricultural Economics, BAU, Mymensingh	Principal Investigator	6084540
				Sub-total	**21193260**
		Nutrition Unit			
35	007	Value addition and standardization of nutritional level in selected food items from Animal and plant origin	Dr. Md. Monirul Islam Member Director (Fisheries), BARC, Farmgate, Dhaka	Coordinator	11477771
			Dr. Swapon Kumar Fouzder Associate Professor, Department of Poultry Science, Patuakhali Science and Technology University (PSTU), Babuganj, Barisal	Principal Investigator	16543232
			Dr. Mst. Afroza Khatun Professor, Department of Dairy and Poultry Science, Hazi Mohammad Danesh Science and Technology University (HSTU), Dinajpur	Principal Investigator	6895640
				Sub-total	**34916643**
36	011	Food-based initiative for improving household food security, income generation and minimize malnutrition	Dr. Md. Monirul Islam Member Director (Fisheries), BARC, Farmgate, Dhaka	Coordinator	7416980
			Dr. Md. Abdul Jalil PSO, Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka	Principal Investigator	18998780
			Dr. Md. Belal Hossain Associate Professor, Department of Fisheries and Marine Science, Noakhali Science and Technology University (NSTU), Noakhali	Principal Investigator	9510540
				Sub-total	**35926300**
37	099	Fortification and standardization of nutritional level in selected human foods and efficacy test of polyphenolic compounds in livestock products	Dr. Md. Monirul Islam Member Director (Fisheries), BARC, Farmgate, Dhaka	Coordinator	4007000
			Md. Golam Ferdous Chowdhury SSO, Postharvest Technology Division, BARI, Gazipur	Principal Investigator	8715000

Sl No.	Project ID	Title of the sub-project	Name of Coordinator and Principal Investigator	Position in the Sub-project	Total Budget (Tk.)
			Dr. Muhammad Ali Siddiquee, CSO and Head, Grain Quality and Nutrition Division, BRRI, Gazipur	Principal Investigator	6278000
			Dr. Mohammad Al-Mamun Professor, Department of Animal Nutrition, BAU, Mymensingh	Principal Investigator	8500000
				Sub-total	**27500000**
38	103	Contamination and adulteration of food and food products, process, chain and mollification	Dr. Md. Monirul Islam Member Director (Fisheries), BARC, Farmgate, Dhaka	Coordinator	12499270
			Md. Hafizul Haque Khan PSO, Postharvest Technology Division, BARI, Gazipur	Principal Investigator	12427550
			Dr. Md. Enamul Hoq PSO, Bangladesh Fisheries Research Institute (BFRI), Mymensingh	Principal Investigator	7064780
				Sub-total	**31991600**

Annex-III (a): List of Awarded Foreign PhD Along With Research Title

Sl #	Name and Address	Research Title
Bangladesh Agricultural Research Institute(BARI)		
1.	Shimul Mondal, Scientific Officer, On-farm Research Division, RARS, BARI, Jessore. mondalbari@gmail.com, 01717-785539	A New Dimension of Using Co-Compost for Sustainable Vegetables Production in Saline and Non-Saline Areas in Southern Part of Bangladesh.
2.	Mamunur Rashid Sarker, Senior Scientific Officer, OFRD, BARI, Joydebpur, Gazipur. barimamun@yahoo.com, 01716-593250	Application of APSIM, GCM and Farm Design Model for Trade-off Analysis of Crop Residue Use in Rice-Maize Systems: Current Status and Way Forward of Conservation Agriculture in Saline Areas of Bangladesh.
3.	Santosh Kumar Paul, Scientific Officer, Agronomy Division, BARI, Joydebpur, Gazipur. santosh87dhaka@gmail.com, 01718-583061	Identification of the Germplasm with Heat Stress Tolerance and Studies on the Tolerant Mechanisms in Wheat.
4.	H.M. Khairul Bashar, Senior Scientific Officer, OFRD, BARI, Sabujbag, Gopalganj. basharlaboni@yahoo.com, 01716-599601	Identification of Key Gene Related to Salt Tolerance and its Tolerance Mechanism of Winter Tomato.
5.	Hafizur Rahman, Senior Scientific Officer, HRC, RARS, BARI, Jamalpur. hafizbau@gmail.com 01718-739457	Morphological and Molecular Characterization and Yield Potential of Banana Germplasm Due to Climate Change and Molecular Detection of Fusarium Oxysporum F.sp. Cubense.
6.	K.A. Md. Mostafizar Rahman, SSO(Biotechnology), TCRC, BARI, Joydebpur, Gazipur. raselnipa02@yahoo.com, 01712-074634	Complete Chloroplast Genome Sequencing and QTL Analysis of BARI Released Stress Tolerant Tetraploid Potato Varieties.
7.	Md. Mosiur Rahman, Scientific Officer (Plant Breeding), Pulses Research Sub-station, BARI, Joydebpur, Gazipur. mosiur1979@yahoo.com 01719-541457	Gene Loci Discovery for Heat Tolerance and Winter Hardy of Grass Pea Based on Genomic Tools.
8.	Shahnewaz Begum, Scientific Officer, Plant Breeding Division, BARI, Joydebpur, Gazipur. shahnewaz_ctg1952@yahoo.com, 01816-202901	Genome Wide Association Mapping of Drought Tolerance in Maize (*Zea mays L.)*
9.	Md. Mahmudul Hasan Khan, Scientific Officer (Oilseed Breeding), RARS, Rahmatpur, Barisal. mhasan.bari12@gmail.com, 01673-167908	Diversity Analysis and Genetic Variability Created in Sunflower (*Helianthus Annuus)* Inbred Lines through Mutagenesis.
10.	Mohammad Shariful Islam, Senior Scientific Officer, On-Farm Research Division, BARI, Kishoregonj. sharifssd31@yahoo.com, 01688-688701	Effect of Tillage Method, Residue Relation and Biochar on soil Health, Cropping System Productivity and Carbon Footprints.
11.	Razu Ahmed, Scientific Officer (Soil Science), Soil& Water Management Section, HRC, BARI, Joydebpur, Gazipur. razuahmed52@yahoo.com, 01717-103502	Carbon and Nitrogen Cycling Under Conservation Agriculture Practices in Vegetable-based Cropping Systems.
12.	Mohammad Amdadul Haque, Scientific Officer, Pomology Division, BARI, Joydebpur, Gazipur. amdad80@gmail.com, 01728-782745	Identification of Suitable Rootstocks for Sweet orange, Tolerant to Abiotic Stress in Different Agro-Ecological Zones of Bangladesh.
13.	Mostak Ahmed, Senior Scientific Officer, On-farm Research Division, BARI, Cox's Bazar. mostakah_79@yahoo.com, 01828-931482	In Vitro Micro Propagation of Sea Weed.
14.	Remi Chakma, Senior Scientific Officer, Seed Technology Division, BARI, Joydebpur, Gazipur. remichakma@yahoo.com, 01556-592222	Bell Pepper Seed Yield and Quality as Influence by Fruit Position on Mother Plant, Fruit Age, Planting Geometry, Training, Micronutrient and Storage.
15.	Sayla Khandoker, Scientific Officer, Agricultural Economics Division, BARI, Joydebpur, Gazipur. skhandoker_86@yahoo.com, 01717-252890	Impact of Environmental and Climate Change in Hill and Coastal Regions of Bangladesh: Assessment of Productivity, Risk and Impact on Livelihoods of the Farmers.
16.	Kowshik Kumar Saha, Scientific Officer, Farm Machinery and Postharvest Process Engineering Division, BARI, Joydebpur, Gazipur. kksaha.bari@gmail.com, 01718-883564	Development of Coastal Ground –Water Pumping Strategy by Combining Satellite Remote Sensing and Predictive Saltwater Intrusion Simulation in the Tropical Aquifer.

Sl #	Name and Address	Research Title
17.	Muhammad Ziaur Rahman, Scientific Officer, Plant Pathology Division, RARS, BARI, Rahmatpur, Barisal. ziapath@gmail.com, 01717-712156.	Biological Control of wheat Blast Disease (Mangaporthe oryzae pathotype triticum) by Using Bacillus Sp. Strains.
18.	ATM Tanjimul Islam, Senior Scientific Officer (Plant Breeding), TCRC, BARI, Joydebpur, Gazipur. tanjim022@gmail.com, 01934-705581	Identification of QTLs in Tomato and Development of both Salt and Powdery Meldew Resistance Varieties.
19.	Shiuli Ahmed, Scientific Officer (Plant Breeding), Biotechnology Division, BARI, Joydebpur, Gazipur. dey_shiuli@yahoo.com, 01717-703725	Marker Assisted Breeding of Sesame (Sesamum indicum L.) to Develop Water Logging Tolerant Genotype(s) with High Yield Potential.
Bangladesh Rice Research Institute(BRRI)		
20.	Md. Abubakar Siddique, Senior Scientific Officer, Genetic Resources and Seed Division, BRRI, Gazipur. mabs198401@yahoo.com, 01731-643193	Mapping Quantitative Trait Loci (QTLs) Using Novel Donor for Early Morning Flowering Trait to Mitigate Heat Stress Damage in Rice.
21.	Md. Rejwan Bhuiyan, Senior Scientific Officer, Plant Pathology Division, BRRI, Gazipur. rejwanbrri@gmail.com, 01726-678978	Pyramiding of Durable Blast Resistant Genes into Popular Rice Cultivar (Cv.BRRI Dhan 28) Using MAS and Standard Different System.
22.	Mohammad Abul Monsur, Senior Scientific Officer, Plant Pathology Division, BRRI, Gazipur. monsurpath@gmail.com, 01731-049024	Exploring Novel Blast Resistance Source and Mapping QLTs for Blast Resistance in Rice.
23.	Bidhan Chandra Nath, Senior Scientific Officer, Farm Machinery and Postharvest Technology Division, BRRI, Gazipur. bidhanbrri@gmail.com 01712-580273	An Assessment of Rice Post –Harvest Quality Losses.
24.	Md. Iftekhar Mahmud Akhand, Senior Scientific Officer, BRRI Regional Station, Bhanga, Faridpur. mimabrri@yahoo.com, 01752-955381	Impact of Conservation Agriculture on Rice Production in Saline Zone Areas of Southern Part of Bangladesh.
25.	Mst. Selima Zahan, Senior Scientific Officer, Agronomy Division, BRRI, Gazipur. selimabrri11@gmail.com, 01717-499740	Breeding for Heat Tolerance, Characterization.
26.	Ripon Kumar Roy, Scientific Officer, Biotechnology Division, BRRI, Gazipur. riponkumar1983@yahoo.com, 01719-593302	Studies on Characterization, Cloning and expression of Candidate Gene/Genes for Drought Tolerance in Rice.
27.	Tapas Kumer Hore, Scientific Officer, Plant Breeding Division, BRRI, Gazipur. tapas.hore@yahoo.com, 01740-597305	QLT Mapping and Candidate Gene Analysis for Grain Micronutrients in Rice (Oryza Sativa).
28.	Md. Adil, Scientific Officer, Plant Breeding Division, BRRI, Gazipur. adil_gpb@yahoo.com 01718-101646	Iron Bio Fortification in Rice of Bangladesh through Multiple Genes Introduction.
29.	Md. Anisuzzaman, Senior Scientific Officer, Plant Breeding Division, BRRI, Gazipur. zaman_brri94@yahoo.com, 01712-095501	Development of High Yielding Rice Varieties for Organic Fertilizer Through Marker Assisted Selection
Bangladesh Jute Research Institute(BJRI)		
30.	Md. Al-Mamun, Senior Scientific Officer, Kenaf Mesta Department, Breeding Division, BJRI, Manik Mia Avenue, Dhaka. almamunbjri@gmail.com, 01711-186051	Assessment of Genetic Diversity and Salinity Tolerance in Kenaf.*(Hibiscus Cannabinus L.)*
31.	Mohammad Munir Hossain, Senior Scientific Officer, BJRI, Jute Research Regional Station, Chandina, Comilla. munibjri@yahoo.com, 01713-376572	Response of Kenaf (*Hibicus Cannabinus* L.) Cultivars to NaCI Induced Salt Stress.
32.	Sultan Ahmed, Scientific Officer, Pest Management Division, BJRI, Manik Mia Avenue, Dhaka. sultanbjri1984@gmail.com,01918-829504	Study on density and Longevity of Micro sclerotia of Macro phomina Phaseolina in Jute Root Tissues and Free on the Soil, And its Competitive Saprophytic Ability.

Sl #	Name and Address	Research Title
33.	Md. Tahzibul Haque, Scientific Officer, Machine Design & Development Section, Jute & Textile Product Development Section, BJRI, Manik Mia Avenue, Dhaka.	Optimization of Phased Approach Project Management
Bangladesh Sugar Crop Research Institute(BSRI)		
34.	Asish Kumar Ghose, Scientific Officer, Biotechnology Division, BSRI, Ishurdi, Pabna. asishbt@yahoo.com, 01712-158406	Genetic Transformation of Sugarbeet Against Fusarium Wilt.
35.	Md. Imam Hossain, Scientific Officer, Plant Pathology Division, BSRI, Ishurdi, Pabna. imam4all@gmail.com, 01723-454478	Characterization of Colletotrichum Falcatum Went Isolates Causing Red Rot of Sugarcane.
36.	KM Rezaul Karim, Senior Scientific Officer, Breeding Division, BSRI, Ishurdi, Pabna. bsrirezaul@yahoo.com, 01712-538878	Generation of Stem Borer Transgenic Sugarcane Using Cry 1 Ac Gene Rationale.
37.	Saiful Islam, Scientific Officer, Soils and Nutrition Division, BSRI, Ishurdi, Pabna. sislam.bsri@yahoo.com, 01717-644915	Influence of Micronutrients on the Growth, Yield and Juice Quality of Sugarcane.
Bangladesh Institute of Nuclear Agriculture(BINA)		
38.	Mohammad Nurun-Nabi Mazumder, Scientific Officer, Planning & Development Cell. BINA, Mymensingh. mnnmbina@gmail.com, 01716-479778	Increasing Shelf Life and Quality of Tomato Fruits Using Stage of Harvest Treatments Including Gamma Radiations.
39.	Mohammad Asad Ullah, Scientific Officer, Plant Breeding Division, BINA, Mymensingh. maullah09@gmail.com, 01712-686497	Construction and Analysis of Salinity-related cDNA Library of Rice and Detection of Salt Tolerant Gene Using Next Generation Sequencing(NGS)
40.	Mohammad Ferdous Ikbal, Scientific Officer, Plant Breeding Division, BINA, Mymensingh. binaikbal@gmail.com, 01717-840065	Rice Improvement for Salt Tolerance through Marker Assisted Back-crossing and Induced Mutation.
41.	Ahmad Numery Ashfaqul Haque, Scientific Officer, Soil Science Division, BINA, Mymensingh. numerybau@gmail.com, 01718-012598	Reclamation of soil Using Organic and Inorganic Amendments for Sustainable Rice Production in Saline Area.
42.	Md. Kamruzzaman, Scientific Officer, Plant Breeding Division, BINA, Mymensingh. kamruzzaman_bina2013@yahoo.com, 01776-960769	Gene Mapping of Blast Resistance Lines of wheat through Induced Mutation and Marker Assisted Backcrossing.
Soil Resources Development Institute(SRDI)		
43	Md. Motasim Ahmeed, Senior Scientific Officer, SRDI, District Office, Faridpur. motasimsrdi@yahoo.com, 01913-341957	Effect of Organic Amendments and Liming in Up-taking Heavy Metals in Rice Growth in Contaminated Soil.
44	Md. Ekhlasur Rahman, Scientific Officer, SRDI Regional Laboratory, Dhaka. ekhlasurrahman02@gmail.com, 01722-001388	Conservation Agriculture for Maximizing Carbon Sequestration and Minimizing Greenhouse Gas Emission From Cereal Based Cropping System.
45	Mehnaz Mosharrof, Scientific Officer, SRDI Central Laboratory, Dhaka. mmd.mehnaz@gmail.com, 01712-688295	Minimization of Nitrogen Losses from Paddy Fields through Ammonia Volatilization Using Organic and Inorganic Source of Nitrogen with Urease Inhibitor.
Bangladesh Livestock Research Institute(BLRI)		
46	Dr. Mohammad Nuruzzaman Munsi, Senior Scientific Officer, Goat & Sheep Production Research Division, BLRI, Savar, Dhaka. nzaman_blri@yahoo.com, 01717255443	Molecular Investigation into Microbial and Chemical Hazards of Meat and Meat Products with Special Emphasis on Indiscriminate Use of Drugs.
47	Md. Shirajul Islam, Senior Scientific Officer & In-charge, BLRI Regional Station, Baghabari, Sirajgonj. siraj_blri@yahoo.com, 01960199249	The comparison of Plasma Hormonal Level Between Normal Cycle Cows and Repeat Breeder Cows at Baghabari Milk Shed Area, Sirajgong.

Sl #	Name and Address	Research Title
48	Muhammad Khairul Bashar, Scientific Officer, Animal Production Research Division, BLRI, Savar, Dhaka. kbashar20@yahoo.com, 01937244291	Life Cycle Assessment (LCA) of Green- house Gas Emission Intensity (Ei) of Dairy Rearing Under Different Production Systems and their Mitigation Options.
49	Dr. Md. Rezaul Karim, Scientific Officer, Animal Health Research Division, BLRI, Savar, Dhaka. rezavetmicro@yahoo.com, 01717320308	Virulence Genes and Antimicrobial Resistance of Emerging and Re-emerging Food Borne Pathogen in Livestock and Poultry Value Chain.
Bangladesh Fisheries Research Institute(BFRI)		
50	Arun Chandra Barman, Senior Scientific Officer, BFRI, Mymensingh. aruncbt@yahoo.com 01718-149804	Gametogenic Phenology Study and Development of a Breeding Protocol in Fresh Water Pearly Molluscan Species; Lamellidens Marginalis and L.corrianus .
51	Md. Shirajum Monir, Senior Scientific Officer, BFRI, Freshwater Station, Mymensingh. monir_bau22@yahoo.com, 01721-624623	Investigation of Economically Important Emerging Diseases of High Valued Fishes (Shing, Heteropneustes fossilis & Koi,Anabas testudineus) of Bangladesh and Development of their vaccines for Laboratory and Field Trials.
52	Md. Moshiur Rahman, Scientific Officer, BFRI, Freshwater Station, Mymensingh. riad242@gmail.com, 01717013264	Stock improvement of Climbing Perch,Koi*(Anabas Testudineus)* of Native Stock through Several Genetic Selection in Bangladesh.
53	Md. Shahzad Kuli Khan, Scientific Officer, Marine Fisheries & Technology Station, BFRI, Cox's Bazar. khanbfri@gmail.com, 01712-970979	Development of seed Production and Larval rearing Technique of Mud Crab Scylla Serrata.
54	Md. Ariful Islam, Scientific Officer, Shrimp Research Station, BFRI, Bagerhat. arifulbau@gmail.com, 01723-888004	Pesticides Used in Rice –Prawn Concurrent Culture Systems and its Impact on Aquaculture Production Systems and Human Health in Bangladesh.
Bangladesh Tea Research Institute(BTRI)		
55	Shovon Kumar Paul, Scientific Officer, Entomology Division, BTRI, Sreemangal, Moulvibazar. shovonbtri@gmail.com, 01556-342527	Molecular Characterization and Development of Suitable IPM Strategies for Tea Mosquito Bag,Helopeltis theivora Waterhouse in Tea.
Bangladesh Forest Research Institute(BFRI)		
56	Sheikh Mohammad Rabiul Alam, Senior Research Officer, Wildlife Section, BFRI, Chittagong. rabiwild@gmail.com	Impact of Climate Change on wildlife in the Coastal Conservation Areas of Bangladesh.
57	Md. Rowson Ali, Senior Research Officer, Seasoning & Timber Physics Division, BFRI, Chittagong. rowson_ali@yahoo.com, 01717-507206	Effect of Heat Treatment on Physical and Mechanical Properties of wood.
Cotton Development Board(CDB)		
58	Khalequzzaman, Scientific Officer, Cotton Research, Training and Seed Multiplication Farm, Sreepur, Gazipur. khalequzzaman30@gmail.com 01712-146447	Quantitative Trait Loci Mapping for Agronomic and Fiber Quality Traits of Cotton Genotypes.
Ministry of Agriculture(MoA)		
59	Farhana Iris, Deputy Secretary, Ministry of Agriculture, Dhaka. farhanairis@yahoo.com 01712730838	Women empowerment in Bangladesh through Participation in Agricultural Activities –Trend and Constraints".
60	Mosammat Mustari Khanaum , Deputy Secretary, Ministry of Agriculture, Dhaka. mustari_khanaum@hotmail.com, 01680136175	Salinity Intrusion in coastal Region of Bangladesh: Environmental Issue and Ecological Imbalance: Cross country Analysis.

Annex-III (b): List of Awarded Local PhD Along With Research Title

SL#	Name and Address	Research Title
Bangladesh Agricultural Research Institute(BARI)		
1	Mohammad Asiqur Rahman, Senior Scientific Officer, On-Farm Research Division, BARI, Tangail. asiqurbari@ymail.com, 01717-210374	Maximizing Yield and Production of Groundnut through Variety Replacement and Quality Management Practices in the Charland Area Bangladesh.
2	Most. Ummay Salma Khatun, Scientific Officer, OFRD, BARI, Rangpur. salma_agron@yahoo.com, 01717-314507	Morpho-Physiological and Qualitative Performance of Off-Season Tomato Under Organic and Inorganic Fertilizer.
3	Haimonti Barua, Scientific Officer, ARS, BARI, Pahartali, Chittagong. haimobari79@gmail.com, 01712-197385	Development of Saline Tolerant Maize (Zea mays) Hybrids in Bangladesh.
4	Iftekhar Ahmed, Scientific Officer, Plant Genetic Resource Centre, BARI, Joydebpur, Gazipur. ifti.bari@gmail.com, 01766-957396	Morpho - Molecular Characterization, Combining Ability and Heterosis in Cucumber(Cucumis Sativus)
5	Md. Nur-E-Alam Siddquie, Senior Scientific Officer, OFRD, BARI, Shyampur, Rajshahi. nsiddquie@gmail.com, 01718-281559	Drought Tolerance and Molecular Characterization in Spring Wheat Genotypes.
6	Mahmuda Ratna, Scientific Officer (Plant breeding), Spices Research Sub-center, BARI, Faridpur. mahmuda.ratna@yahoo.com, 01717-463599	Development of Chili Hybrid (s) Tolerant to Water-logging.
7	Shammi Akhtar, Scientific Officer (Plant Breeding), OFRD, BARI, Mymensingh. shammiakhter_bari@yahoo.com, 01716-281509	Morpho-Molecular Screening for Aphid Resistance in country bean.
8	Mohammad Mostafa Kamal, Scientific Officer (Entomology), Regional Spices Research Centre, BARI, Joydebpur, Gazipur. mamunsrc@gmail.com, 01818-285794	Bio-Ecology of Onion (Thrip Tabaci) and its Management.
9	Md. Nazmul Islam, Scientific Officer, Seed Technology Division, BARI, Joydebpur, Gazipur. mni81@yahoo.com, 01711-075229	Quality Seed Production and Storability of Bt Brinjal as influenced by Stage of Maturity ,Fruit Thinning and Post –Harvest Ripening.
10	Rummana Islam, Senior Scientific Officer, Plant Pathology Division, BARI, Joydebpur, Gazipur. rummna77@yahoo.com, 01717-327437	Molecular Characterization of Citrus Canker Pathogen, Xanthomonas *Axonopodis* Pv. *Citri* and its Management Through Bio-rational Products.
11	Md. Abdul Wadud, Scientific Officer (Plant Pathology), Spices Research Centre, BARI, Shibgonj, Bogra. wadudbari@yahoo.com, 01743-073138	Study on Stemphylium Leaf Blight [Stemphyliumvesicarium(Wallr.)E. Simmons] of Garlic (Allium Sativum L.) and its Management in Bangladesh.
12	Shamima Aktar, Scientific Officer (Soil Science), Pulses Research Sub-station, BARI, Joydebpur, Gazipur. shamimaprc@gmail.com, 01718-082516	Requirement of Boron in the Fieldpea-Mungbean-T.Aus-Blackgram and Zinc in the Lentil – Mungbean-T.aus-T.aman Cropping Pattern in Calcareous and Non-calcareous Soils of Bangladesh.
13	Mohammad Shamsul Hoq, Scientific Officer, Agricultural Economics Division, BARI, Joydebpur, Gazipur. shamsul305@yahoo.com, 01716-330898	Socioeconomic Impact of Haor Agriculture on Livelihood Pattern, Crop Production and Rural Agricultural Market in Haor Region of Bangladesh.
14	Mohammed Moniruzzaman, Scientific Officer (Horticulture), Plant Physiology Section, HRC, BARI, Joydebpur, Gazipur. mzaman.hrcbari@yahoo.com, 01550-605705	Screening of Salt Tolerant Tomato Genotypes Evaluating Physiological, Biochemical and Yield Potential Traits.
15	Md. Moniruzzaman, Senior Scientific Officer, Agricultural Research Station, BARI,Pahartali, Chittagong. badal_kbd@yahoo.co.in, 01711-947499	Inter varietal Hybridization in Mango (Mangifera Indica L.)
16	Nizam Uddin Ahmed, Senior Scientific Officer (CC), TCRC, BARI, Munshigonj. nizamso92@yahoo.com 01711054008	Influence of Water Deficit Stress For Reappearance of Potato Genotypes for Sustainable Crop Production.

SL#	Name and Address	Research Title
17	Md. Faruq Bin Hossain, Scientific Officer, Postharvest Technology Division, BARI, Joydebpur, Gazipur. yaminbari@gmail.com, 01712-577812	Formulation and Protocol Development of Pesticide Decontaminant.
18	Mohammad Mukhlesur Rahman, Scientific Officer, ASICT Division, BARI, Joydebpur, Gazipur. mukhlesur@bari.gov.bd, 01712-943897	Estimation of Potato Acreage and Yield by Synergistic Use of RS,GIS & Ground Sampling Techniques in Major Potato Growing Areas of Bangladesh.
19	Sabina Yesmin, Scientific Officer, Biotechnology Division, BARI, Joydebpur, Gazipur. moly.mdp@gmail.com, 01925-730011	Characterization of Mungbean Genotypes for Drought Tolerance Using Physiological and Molecular Markers.
20	Shahnaj Pervin, Scientific Officer (Food Technology, Postharvest Technology Division, BARI, Gazipur spervin_bari@yahoo.com, 01720049134	Development of Shelf Stable Dehydrated Products From Plum (Alu Bukhara) for Primary and Secondary Use.
21	Abdul Hannan, Senior Scientific Officer, Seed Technology Division, BARI, Joydebpur, Gazipur. hsag_04@yahoo.com, 01715-483051	Morpho-Physiological and Biochemical Mechanism of Salinity Tolerance in Wheat.
Bangladesh Rice Research Institute(BRRI)		
22	Niaz Md. Farhat Rahman, Senior Scientific Officer, Agricultural Statistics Division, BRRI, Joydebpur, Gazipur. niaz.sust@gmail.com, 01912700606	Simulation of Climate Change Impact on Rice Growth and Yield in Bangladesh Using DSSAT Model.
23	Nargis Parvin, Senior Scientific Officer, Rice Farming Systems Division, BRRI, Joydebpur, Gazipur. nargisrfs@gmail.com, 01816-938583	Partitioning and Quantifying Contribution of Genotype, Environment and Management Components on Enhancing Rice Yield in Single Transplant Aman Cropping System.
24	Shakir Hosen, Scientific Officer, Grain Quality and Nutrition Division, BRRI, Joydebpur, Gazipur. shakir.roman@yahoo.com, 01819-501465	Characterization of Anthocyanin Enriched Local Germplasm to Evaluate Anticancer Activities in Vivo Experiments.
25	Md. Hannan Ali, Scientific Officer, Irrigation and Water Management Division, BRRI, Joydebpur, Gazipur. hannan_aen@yahoo.com, 01936-953626	Expt. Cropping Pattern Based Water Management for Different Crops in Saline Prone Areas of Bangladesh.
26	Sheikh Maniruzzaman, Scientific Officer, Plant Breeding Division, BRRI, Sagardi, Barisal. skmonir85@yahoo.com, 01712-996391	Exploring Salt Tolerant Donor and Mapping Quantitative Trait Loci (QTLs) for Salt Tolerance Using Bangladeshi Rice Germplasm.
27	Mohammad Abdul Momin, Senior Liaison Officer, Office of the Director (Research), BRRI, Joydebpur, Gazipur. smmomin80@gmail.com, 01716-540380	Identification of the Adoption Gaps of BRRI Released Varieties to Develop a Theoretical Model for Rapid Dissemination.
Bangladesh Jute Research Institute(BJRI)		
28	Arju Miah, Senior Scientific Officer, Gene Bank Department, Genetic Resources & Seed Division, BJRI, Manik Mia Avenue, Dhaka. arjumia146@gmail.com, 01720-296611	Molecular Characterization and Genetic Transformation in White Jute *(Corchorus Capsularis. L)*
29	Mohammad Shahadat Hossain, Senior Scientific Officer, Crop Management Department, Agronomy Division, BJRI, Manik Mia Avenue, Dhaka. shahadatbjri@gmail.com, 01718-081885	Weed Dynamics in Jute (Corchorus Capsularis L. and C. Olitorius L.) and their Climate Smart Weed Management Techniques for Higher Fiber Yield and Quality in Bangladesh.
30	Md. Kamrujjaman, Senior Scientific Officer, Soil Science Department, Agronomy Division, BJRI, Manik Mia Avenue, Dhaka. jony_orna@yahoo.com, 01711-043282	Assessment of Moleculation Level Variation and Genetic Transformation of Kenaf (Hibiscus Cannabinus).
31	Shamina Jafrin, Senior Scientific Officer, BJRI, Manik Mia Avenue, Dhaka. sjafrin@gmail.com, 01913616150	Produce Environmental Friendly New Ligno Based Bio-Polymer as an Alternative to Plastic and its Industrial Uses.
32	Md. Shafiqul Hasan, Senior Scientific Officer, Training Department, Planning, Training & Communication Division, BJRI, Manik Mia Avenue, Dhaka. shafiqulbjri@gmail.com, 01911-250553	Assessment of Fiber Yield and Quality with Agronomic and Economic Means of Kenaf Varieties in Different Growing Region of Bangladesh.

Bangladesh Sugar Crop Research Institute(BSRI)		
33	Sayed Shams Tabriz, Senior Scientific Officer, Agricultural Engineering Division, BSRI, Ishurdi, Pabna. tabriz_bsri@yahoo.com, 01719-862293	Development of Raised Bed Former as Resource Saving Technology for Sugarcane Cultivation with Intercrop.
34	AKM Rashadul Islam, Senior Scientific Officer, Agronomy & Farming Systems Division, BSRI, Ishurdi, Pabna. bsri_rashadul@yahoo.com, 01714-160909	Adaptability and Stability of Tropical Sugarbeet Cultivars for Higher Yield and Quality of Juice at Different AEZ's in Bangladesh.
35	Nilufar Islam, Senior Scientific Officer, Regional Station, Joydebpur, Gazipur, inilufar@yahoo.com 01711-146775	Genotypic Variation in Yield and Postharvest Quality of Chewing Cane Under Different Management Practices.
36	Md. Munir Hossain, Senior Scientific Officer, Training and Technology Transfer Division, BSRI, Ishurdi, Pabna. bsrimunir@yahoo.com, 01711-846853	Growth Yield and Quality of Sugarbeet as Influenced by Sowing Methods,Weed Interference and Nitrogen Fertilizer.
37	Mst. Ismat Ara, Principal Scientific Officer, Entomology Division, BSRI, Ishurdi, Pabna. ismatbsri@gmail.com, 01711-959559	Bio-Ecology and Sustainable Management of Sugarbeet Caterpillar, Spodoptera Litura Fab.(Noctuidae:Lepidoptera).
Bangladesh Institute of Nuclear Agriculture(BINA)		
38	Mohammad Rashidul Haque, Senior Scientific Officer, Agricultural Economics Division, BINA, Mymensingh. rashidul.bina@gmail.com, 01717-253073	Potential of BINA Related Salt Tolerant Rice Varieties for the Sustainable Food Supply in the Economy of Bangladesh.
39	Mohammad Elius Hossain, Scientific Officer, Soil Science Division, BINA, Mymensingh. eliusbina09@gmail.com, 01716-131689	Requirement of Zinc and Boron Application for Rice Based Cropping Pattern in Old Brahmaputra Floodplain Soil.
40	Rakhi Rani Sarker, Scientific Officer, Soil Science Division, BINA, Mymensingh. rrssarker@gmail.com 01722-460015	Effect of Tillage and fertilizer on Soil carbon and Nitrogen Sequestration Using Stable Isotope Tracer Technique.
41	Tania Sarmin, Scientific Officer, Agronomy Division, BINA, Mymensingh. sarmintania95@gmail.com 01716-157287	Morpho-Physiological and Molecular Characterization of Salinity Tolerance of Wild Rice Porteresiacoarctata.
Soil Resources Development Institute(SRDI)		
42	Kazi Kaimul Islam, Senior Scientific Officer, SRDI, Dhaka. kazisrdi@yahoo.com, 01716-684946	Improved Soil and Land Management to Enhance Carbon Sequestration for Sustainable Corp Production and Climate Change Mitigation.
43	Md. Harun-Or-Rashed, Scientific Officer, SRDI Regional Laboratory, Comilla. harun.srdi@gmail.com 01914-707369	Integrated Management of Manganese in Some Soils of Bangladesh along with the Influence of Crop Yield (Wheat And Soybean).
44	Nazmul Haque Khan, Scientific Officer, Central Laboratory, SRDI, Dhaka. nazmulsrdi75@gmail.com 01718-533730	Bio-availability of Heavy Metal in Soils Around Dhaka City and its Distribution in Leafy Vegetables with Potential Health Risks.
45	ABM Masud Hasan, Scientific Officer, Salinity Management and Research Center, SRDI, Batiaghata, Khulna. abmmasud76@yahoo.com, 01716-853126	Yield Maximization of Maize through Salinity Tolerant Variety Selection with Improved Management Practices in the Coastal Saline Belt of Bangladesh.
Bangladesh Livestock Research Institute(BLRI)		
46	Most. Mahfuja Khatun, Scientific Officer, Socioeconomic Research Division, BLRI, Savar, Dhaka. mahfuja_1986@yahoo.com, 01716-576437	Analysis of Profitability of Milk Production: Challenges and Opportunities for Daily Development in Bangladesh.
47	ASM Ashab Uddin, Scientific Officer, Training, Planning and Technology Testing Division, BLRI, Savar, Dhaka. ashabvet12@gmail.com,01787282862	Efficacy Trial of BLRI Developed Inactivated Trivalent FMD Vaccine (O,A,Asia-1) in Cattle at Selected Areas of Bangladesh.

Bangladesh Fisheries Research Institute (BFRI)		
48	Akhery Nima, Senior Scientific Officer, BFRI, Reverine Station, Chandpur. nima07@gmail.com 01728949185	Conservation of Yellowtail Catfish, Pangasius Pangasius*(Hamilton,1822)*in Bangladesh through Multiple Approach.
49	Mohammad Ferdous Siddique, Senior Scientific Officer, BFRI, Mymensingh. siddique.bfri@gmail.com 01722985525	Preparation of Nuclei, Culture and Post Harvest Management of Pearl in In-Vitro Condition.
50	Mohammed Ashraful Haque, Senior Scientific Officer, Maine Fisheries & Technology Station, BFRI, Cox's Bazar. ashrafbfri@yahoo.com, 01712-781357	Bionomics, Population dynamics and Blue Economy of Four Commercial Fishes from the Bay of Bengal, Bangladesh.
51	Tayfa Ahmed, Senior Scientific Officer, BFRI, Reverine Station, Chandpur. tayfa.bfri@gmail.com 01712-290950 ,01816-546101	Impact of Climate Change on the Ecology and Fish Diversity in the Lower Meghna River.
52	Md. Mehedi hasan pramanik, Scientific Officer, BFRI, Riverine Station, Chandpur. mehedibfri@gmail.com, 01720618000	Study on the Fish Biodiversity in the River Jamuna with Conservation Aspect in the Content of Climate Change.
53	S. Sanjib basak, BFRI, Reverine sub-station, Rangamati. sanjibbasak25@yahoo.com, 01718-942672	Population Dynamics and Stock Assessment of Gudusia Chapra & Corica Soborna in the Kaptai Lake.
Bangladesh Tea Research Institute(BTRI)		
54	Apu Biswas, Scientific Officer, Soil Science Division, BTRI, Sreemangal, Moulvibazar. jlatdu_06@yahoo.com, 01717-129217	Presence of Arsenic and other Heavy Metals in Tea Soils and its Effect on Quality of Tea.
Bangladesh Forest Research Institute(BFRI)		
55	Md. Motiar Rahman, Senior Research Officer, Soil Science Division, BFRI, Chittagong. swapon_bfri@yahoo.com, 01716-898222	Effect of Different Acacia Tree Species on Soil Properties in Different sites of Bangladesh.
56	Md. Shah Alam, Research Officer, Minor Forest Product Division, BFRI, Chittagong. sahalam25@yahoo.com, 01719-777897	Improved Propagation, Cultivation and Management Techniques of Some Important Wild Medicinal Plants of Bangladesh.
Cotton Development Board(CDB)		
57	H.M. Syfullah Azad, Senior Scientific Officer, Cotton Research Farm, Sadarpur, Dinajpur. syfullahazad@gmail.com, 01711-186833	Nutritional Indices and Comparative Reproductive Performance of Bollworm, *helicoverpa armigera* HÜbner (*Lepidoptera:Noctuidae*) on Selected Cotton Varieties.
Bangladesh Sericulture Research and Training Institute(BSRTI)		
58	Faruque Ahmed, Research Officer, BSRTI, Baliapukur, Padma R/A, Rajshahi. moistfaruk@gmail.com 01733-257913	Advanced Fertilizer and Common Disease Management Practices for Mulberry Plant Production.
59	Rumana Ferdous Bint-A- Rahman, Research Officer, BSRTI, Baliapukur, Padma R/A, Rajshahi. rumanabsrtigeb@gmail.com, 01717-636522	Genetic Enhancement and Stability Performance of Some Quantitative Traits in the Silkworm *(BOMBYX MORI* L.*)*.
60	Md. Shakhawat Hossain, Research Officer, Seri-Chemistry Section, BSRTI, Baliapukur, Padma R/A, Rajshahi. mithu400sh@gmail.com, 01717-496400	Separation and Characterization of Sericin from Silkworm (Bomby x Mori L.)Cocoon and Study on its Possible Applications.

Department of Agricultural Extension (DAE)		
61	Mahbuba Moonmoon Additional Deputy Director (Fruits & Flowers), Horticulture Wing, Department of Agricultural Extension, Khamarbari, Dhaka.	Factor Contributing to Farmers' Satisfaction with Extension services of the Department of Agricultural Extension.
62	Sukalpa Das Upazilla Agriculture Officer Fulpur, Mymensingh	Molecular Characterization of Meloidogyne SPP of Brinjal and Development of Sustainable Bio-management
63	Md. Mozammal Hossain Upazilla Agriculture Officer (LR), Attached Control Room, Field Services Wing, Department of Agricultural Extension, Khamarbari, Dhaka.	Assessment of Climate Change Impact and Adaption on Costal Region for Sustainable Food Production in Bangladesh.
64	Md. Raquibuzzaman Khan Additional Deputy Director (P.S. to DG) Department of Agricultural Extension, Khamarbari, Dhaka.	Procurement Management in Public Sector Agriculture Project. The Bangladesh Perspective.
65	Md. Abu Sayem Regional Farm Broadcasting Officer Agricultural Information Service, Regional Office, Rangpur.	ICT Based Agricultural Extension Services: Transformation of Extension Approaches in Bangladesh.
66	Md. Mamunur Rahman Upazilla Agriculture Officer, Kazipur, Sirajgonj.	Conservation Agriculture, Trico Compost, Vermi Compost, Soil Health.
67	A. K. M. Amdadul Hoque Senior Assistant Director, National Agriculture Training Academy (NATA), Gazipur.	Developing a Sustainable Disease Management Model for Safe Vegetable Production in Bangladesh.
68	Kaniz Suraya Sultana Upazilla Agriculture Officer Delduar, Tangail	Management of Brinjal Shoot and Fruit Borer (Leucinodes orbonails) through Integrated and Eco-friendly Horticultural Techniques.
69	Mohammad Liakat Hossain Khan Senior Monitoring & Evaluation Officer Citrus Development Project, Department of Agricultural Extension, Khamarbari, Dhaka.	An Assessment of Common Interest Groups an Effective Extension Approach
70	Md. Abu Zafur Al Munsur Senior Instructor Agricultural Training Institute, Sher-e-Bangla Nagar, Dhaka.	Climate Change Impacts on Rice Production in Bangladesh.

Annex-IV: List of Personnel in PIU-BARC, NATP-2 as on 30 June 2018

Sl	Name and Position	Address
1.	Dr. Mian Sayeed Hassan Director	Address: Address Sami, House#202, Road#07, Flat#A3, Mohammadpur Housing Society, Dhaka-1207, Mobile No: 01911-740390 E-mail: directornatpbarc@gmail.com
2.	Dr. Md. Abdul Jalil Bhuyan Research Management Specialist	Address: House # 61, Road # 16, Sector# 11, Uttara, Dhaka-1230 Mobile No: 01552-491457 E-mail: maj.bhuyan54@yahoo.com
3.	Md. Mokhlesur Rahman Training & Communication Specialist	Address: 58, 1/b, West Rajabazar, Farmgate, Dhaka Mobile No: 01710-807313 E-mail: mokhles12@yahoo.com
4.	Mohammad Assaduzzaman Manager (Financial Management)	Address: 84/23, Vasantac, Dhaka Cantonment, Dhaka Mobile No: 01912-241-929 E-mail: natp.barc.fin@gmail.com
5.	Fatema Samdani Roshni Procurement Specialist	Address: Road # 1, House # 50, Apartment AC-1, Block # I, Banani, Dhaka Mobile No: 01766-573208 E-mail: fsroshni@yahoo.com
6.	Mohammad Abdullah Al-Faroque Assistant Manager (Administration)	Address: 1/21/5, East Bashabo, Kadamtola Road, Shabujbag, Dhaka-1214 Mobile No: 01711-061147 E-mail: faroquekbd@gmail.com
7.	Md. Ashequr Rahman Assistant Manager (Accounts)	Address: C/O- Md. Abdul Malek, BUTEX R/A-1, Dalia Building, C/13, South Begunbari, Tejgaon, Dhaka Mobile No: 01912-575317 E-mail: asik0852@yahoo.com
8.	Munshi Mamunur Rahman Documentation Associate	Address: House # 42, Road # 4, Monsurabad, Adabor, Dhaka Mobile No: 01978-387610 E-mail: mamun71t@yahoo.com
9.	Md. Abdur Rahman Monitoring Associate	Address: 24, Monipuripara, Sangsod Avenue, Tejgaon, Dhaka-1215 Mobile No: 01711-233030 E-mail: agriltechnology@gmail.com
10.	Mr. Dipok Kumar Monitoring Associate	Address: 101, Niribili (7th Floor), West Raja Bazar, Dhaka. Mobile No:01716-210375 E-mail: dipokbarc@gmail.com
11.	Mr. Md. Hasan Mahmud Capacity Development Associate	Address: 146, Bochila (South) 2nd Floor, Mohammadpur, Dhaka-1207. Mobile No: 01819-187798 E-mail: cdanatp2@gmail.com
12.	Nadia Rahnuma Accountant	Address: 40/2, Zigatola, Dhaka Mobile No: 01670-017531 E-mail: rahnuma13@gmail.com
13.	Monir Ahamed Khondaker Accountant	Address: H # 3/C, R # 1, Block # kha, Pisiculture Housing Society, Mohammadpur, Dhaka Mobile No: 01916-045587 E-mail: ripon782002@yahoo.com
14.	Mr. Md. Anowarul Islam Computer Operator	Address: 56 (Middle building), West Rajabazar, Dhaka Mobile No: 01630-277172 E-mail: maislam.nijhum@gmail.com
15.	Ms. Asma Akhter Computer Operator	Address: 279, Zafrabad, Shonkor, Dhaka Mobile No: 01911-283203 E-mail: asla9@yahoo.com

Sl	Name and Position	Address
16.	Md. Shahinur Islam Photocopy, Multimedia, PA System Operator	Address: College Road, Bank Colony, Block #H, 60/1, Savar, Dhaka Mobile No: 01818-280849
17.	Md. Shahidullah Driver	Address: 559, Monipur, Mirpur-2, Dhaka Mobile No: 01712-618698
18.	Md. Robiul Islam Driver	Address: BARC Colony, House# 17, Farmgate, Dhaka Mobile No: 01917-007789
19.	Md. Tofayal Ahmed Account Assistant	Address:58/ka3, Kuril Badda, Dhaka Mobile No. 01731-909627
20.	Md. Rubel Islam Office Support	Address: Houise # 100/1E, South Pirerbag (Paka Mosjid), Mirpur, Dhaka Mobile No: 01737-488798
21.	Most. Kamrunnahar Messenger/Dispatcher	Address: 415/1, South Paikpara, Road#18, Mirpur, Dhaka Mobile No: 01718-082119
22.	Md. Mainuddin Cleaner	Address: House # 31/9, Shahibag, Savar, Dhaka Mobile No: 01917-927349
23.	Fatima Begum Cleaner	Address: 35/2, Golapbag, Sayedabad, Dhaka Mobile No: 01727-690034