

Annual Report 2015-16



Bangladesh Agricultural Research council

National Agricultural Research System (NARS)

Institute	Ministry	Areas of Research
Bangladesh Agricultural Research Council (BARC), Dhaka	Agriculture	Strengthen the national agricultural research capability through research planning, coordination, integration and resource allocation
Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur	Agriculture	Basic, applied and adaptive research on cereals (other than rice), pulses, oilseeds, vegetables, horticultural crops etc.
Bangladesh Rice Research Institute (BRRI), Joydebpur, Gazipur	Agriculture	Basic, applied and adaptive research on rice
Bangladesh Jute Research Institute (BJRI), Sher-e-Bangla Nagar, Dhaka	Agriculture	Basic, applied and adaptive research on jute production and utilization
Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh	Agriculture	Application on nuclear technology in agriculture
Bangladesh Sugarcrop Research Institute (BSRI), Ishurdi, Pabna	Agriculture	Applied and adaptive research on sugarcrops
Soil Resource Development Institute (SRDI), Farmgate, Dhaka	Agriculture	Soil survey, soil classification and soil characterization
Cotton Development Board (CDB), Khamarbari, Farmgate, Dhaka	Agriculture	Cotton production and research
Bangladesh Fisheries Research Institute (BFRI), Mymensingh	Fisheries and Livestock	Marine and freshwater fisheries research
Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka	Fisheries and Livestock	Basic and applied research on cattle, buffalo, sheep, goats, poultry, duck, etc.
Bangladesh Forest Research Institute (BFRI), Sholashahar, Chittagong	Environment and Forests	Forestry and agroforestry research
Bangladesh Tea Research Institute (BTRI), Srimangal, Moulvibazar	Commerce	Applied and adaptive research on tea
Bangladesh Sericulture Research and Training Institute (BSRTI), Baliapukur, Rajshahi	Textile and Jute	Research and training on sericulture

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I. HIGHLIGHTS OF RESEARCH AND DEVELOPMENT

CROPS

Project Implementation

AFACI Project:

Collection, characterization and Promotion of rice, chilli, cucumber and melon in Bangladesh (2nd Phase) during January 2015 to December 2017

A Pan Asian project *Integrated Management System of Plant Genetic Resources (IMPGR)* under the financial assistance of Asian Food & Agriculture Cooperation Initiative (AFACI) has been implementing in its eleven member countries since January 2015. As a member of AFACI, Bangladesh is also implementing a project entitled *Collection, characterization and utilization of rice, minor cereals and chilli in Bangladesh* under IMPGR project. The Specific objectives of this project are: i) to collect rice, chilli, cucumber and melon germplasm from coastal, hilly, swamp and char areas of Barisal (coastal), Jessore, Rangpur (char), Mymensingh (char and swamp), Dhaka (char and swamp) and Chittagong (hill) regions; ii) to characterize the collected and conserved germplasm of target crops following standard descriptors; iii) to secure sustainable

use, regeneration, and conservation of collected germplasm. iv) to develop data base management system for collected germplasm and superior germplasm selection for distribution to plant breeders and exploit in crop improvement program.

BARC is acting as coordinating agency while BARI and BRRI as implementing organization. The major achievements of the project during January 2015 to June 2016 are as follows:

Collection: A total of 754 germplasm of chilli, melon and cucumber have been collected by BARI and 96 rice germplasm have been collected from different parts of the country by BRRI

Characterization: Chilli-195, cucumber-56 and melon-136 germplasm have been characterized morphologically

Regeneration: A total of 46 rice and 195 chilli, 10 cucumber and 147 melon germplasm have been regenerated.

Evaluation: A total of Chilli-195 germplasm have been evaluated against *Rhizoctonia solani*.



Germplasm collection photograph



Diversity in collected Melon germplasm

Establishment of network and model manual on postharvest technology of horticultural crops in Bangladesh (September 2012 to October 2015)

The project is completed properly and its achievements are as follows-

- The postharvest network has developed with 55 professionals in Bangladesh.

- Two manuals on cabbage and tomato have been developed and published both in Bangla and English 3000 copies each.
- About 500 manual each of cabbage and tomato have been distributed in different stakeholders and individuals.
- Awareness and capacity building on postharvest management of horticultural crops have been developed through the project activities, like training and review workshops.

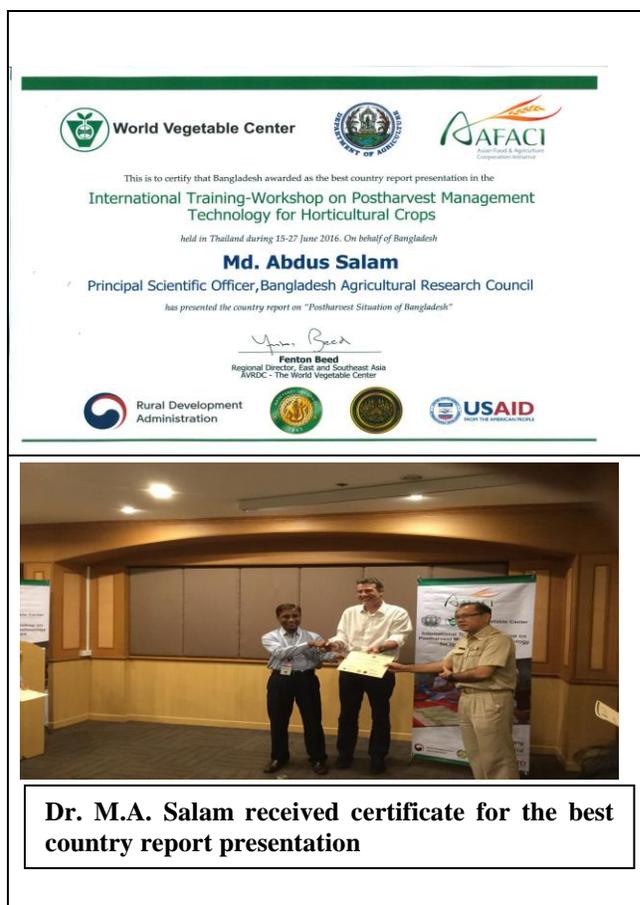
- The manuals published on tomato and cabbage would help to minimize postharvest loss in Bangladesh.
- Improved postharvest handling technologies are being applying in the postharvest horticultural industries.

AFACI-Postharvest Project (Jan 2016-Dec 2018) (2nd Phase)

The PI of AFACI-Postharvest Project Dr. Md. Korshed Alam prepared AFACI-Postharvest Project Proposal (Jan 2016-Dec 2018) (2nd Phase) and submitted to AFACI Head Quarter in Korea. The 2nd Phase of the project entitled “Application of Improved Postharvest Handling of Mango in Postharvest Industry in Bangladesh” was approved by the AFACI authority and the project is under implementation.

Human resource interaction under AFACI Project

- *AFACI Program Workshop on Basic Agriculture* held at Hanoi, Vietnam on 18-22 Aug 2015, PI of this project attend the workshop.
- 4th AFACI International Training Workshop on “Germplasm Management System” held at Jeonju, Korea on 18-27 April, 2016; two participants from BARI and BRRI were attended this training workshop.
- PI of AFACI-GAP project was attended in the AFACI workshop on during 25-29 October, 201 at Manila in Philippines 5and Concluding report of AFACI-GAP was presented.
- Dr. S.M. Korshed Alam, PI of AFACI-Postharvest Project participated in the Program Workshop of Horticulture held during 25-29 October 2015 at Manila in Philippines and he presented the Country Report of AFACI-Postharvest Project (1st Phase).
- Co-PI of AFACI attended to 2nd *AFACI International Training-Workshop on Postharvest Management Technology for Horticultural Crops* Postharvest Management Project in Thailand on 14-28 June 2016. Bangladesh awarded as the best country report presentation among the 11 member countries of AFACI.



Dr. M.A. Salam received certificate for the best country report presentation

Training Programme on AFACI Post harvest

A three days long training program was organized on “Postharvest management and technology of mango” under AFACI-Postharvest Project (2nd Phase) during 16-17 May 2016 at Regional Horticulture Research Centre, BARI, Chapainawabganj. Total 50 participants in two batches (25 persons in each batch) including mango growers, traders, retailers and extension personnel were attended in the training programs. Improved postharvest management and technology of mango were taught in the training program (theoretical as well as practical).

Project Completion workshop AFACI GAP Project

Project Completion Workshop on AFACI-GAP Project was held on 13 October 201 for implementing Good Agricultural Practices (GAP) programmes for improving the safety of agricultural produces in Bangladesh. Sixty scientists, extension personnel and officials of BARI, BARC, FAO, DAE etc. were

participated. In the workshop, Dr. Mian Sayeed Hassan, PI of the project presented the three year's activities and achievement of the project. These were as follows:

- Base line survey on GAP and food safety assurance have been conducted;
- Two GAP manuals of Mango and Tomato have developed and ready to print, which is the first document of this issue.
- GAP network in Bangladesh developed with 35 professionals;
- GAP professionals have been developing through training (2-batches comprising 80 scientists & professionals) on 'GAP principles for Fruits & Vegetables Production';
- GAP training for mango farmers at mango growing area initiated first time in Bangladesh;
- Training lecture on GAP concept and principles have been translated in local language-Bengali which is using in different training programme for farmers and professionals.
- Technical knowledge and skills developed on GAP is being sharing with other stakeholders for developing GAP activities and projects.

Project Completion workshop AFACI postharvest Project

Project Completion Workshop on AFACI-Postharvest Project entitled *Establishment of network and model manual on postharvest technology of horticultural crops in Asia* under AFACI Project was held on 13 October 2016. The three year's activities and achievement of the project was presented in the workshop by Dr. S.M. Korshed Alam, PI of the project. About 60 scientists, extension personnel and officers related to the postharvest management activities of horticultural crops were participated in the workshop.

Expert coordination meeting on AFACI-Postharvest project (2nd phase)

An Expert **coordination** meeting on AFACI-Postharvest project (2nd phase) was held at 19-04-2016 for developing practical postharvest handling manual

for mango. Activities to be carried out in the 2nd Phase of the AFACI-Postharvest Project were thoroughly discussed in the meeting.

Inception Workshop on 2nd phase of AFACI-Postharvest project on Application of improved postharvest handling of mango in postharvest industry in Bangladesh"

An Inception Workshop on 2nd phase of AFACI-Postharvest project entitled "Application of improved postharvest handling of mango in postharvest industry in Bangladesh" was held 09 May 2016 for discussing the reduction of postharvest loss of mango after field application of the improved postharvest handling technologies . Thirty participants including scientists, extension personnel and officials related to postharvest management activities of horticultural crops were present in the workshop.

Monitoring and Evaluation of Core Research Projects

Evaluated 1st year project activities (2014-2015) of 17 core research grant project of BARC implementing by different organization. As a team member (formed by Planning and Evaluation division, BARC) the scientists of crops division have monitored project activities (2015-2016) of 7 core research grant project of BARC implementing by different organization during March 2016 . The monitoring reports were also presented in the review workshop organized by P&E Division, BARC. As a member of the SAU-Res, Member Director (Crops) evaluated SAU-Research Projects at field level.

National and International Linkages (MoU/Bilateral agreement, Collaborative Work plan signed during the year. Highlights of activities undertaken under the MoU/Agreement, etc.

- Prepared agenda for 33rd FAO Regional Conference for Asia and the Pacific
- Prepared comments on bilateral cooperation between Bangladesh and Austria
- Prepared comments on the draft MoU between BARC and CIMMYT. Thereafter Revised and modified copy of MoU sent to MoA

- Provided the information according to CGIAR ISPC online survey on research prioritization and submitted
- Provided the information according to the questionnaire relate to issues covered by Convention No184 and Recommendation No 192 according to Article 19 Report Form Concerning Occupational Safety And Health Instruments and sent to MoA.
- Prepared work plan for feasibility study (8 days) by the technical committee (as per MoA) on jute cultivation in Sri Lanka.
- Concept note on the feasibility study on jute cultivation in Sri Lanka revised and final version sent to the MoA.
- As per decision of the 10th JEC between Bangladesh-Saudi Arabia, the progress report sent to the MoA.
- Input provided for the agenda of 11th JEC of Bangladesh-Saudi Arabia.
- Input provided for Bangladesh and Vietnam cooperation in relation to agriculture.
- Input provided for Foreign Office Consultation between Bangladesh and Sudan bilateral issues in agriculture.
- Inputs in relation to agriculture provided for Bangladesh and Netherlands cooperation.
- Prepared proposal on “Scientific basis and protocol to be followed during issuance of License for Pesticides” and sent to MoA.
- Prepared progress report on Istanbul Program of Action and sent to MoA.
- Input provided for Honourable Prime Minister visit to France and sent to MoA.
- Input provided for Foreign Office Consultation between Bangladesh and Iran for enhancing agricultural cooperation and sent to MoA.
- Input provided to MoA regarding MoU between Bangladesh and Tanzania.
- Input provided regarding 31st Session of COMCFC in Istanbul and sent to MoA.
- Input provided to MoA regarding MoU between Bangladesh and Fiji.
- Input provided to MoA regarding MoU between Bangladesh and Lithuania.
- Proceedings of NTCCB Core Committee meeting regarding import of Hybrid BT Brinjal seeds from Mahyco sent to MoA.
- Comments on MoU between Bangladesh and Lithuania was prepared and sent to MoA.
- Prepared report on Reducing On Farm Losses in Bangladesh for participating Bangladesh Mission to 7th meeting of the COMCEC Agriculture Working Group and sent to MoA.
- Input provided to MoA regarding MoU between Bangladesh and Australia
- Input provided regarding International Islamic Trade Finance Corporation delegates meet with MoA Secretary.
- Input/Talking points sent to MoA for Inter-Ministerial Meeting on Bangladesh-Russian Federation Foreign Office Consultation held on 21 March 2016 in Moscow.
- Input sent to MoA on Cooperation in the field of Agriculture between Bangladesh and Saudi Arabia.
- Different concept notes and success stories sent to MoA for sending SAARC Secretariat, Nepal regarding the occasion of Third Meeting of SAARC Ministers of Agriculture Preceded by the Senior Official’s Meeting and the 8th Technical Committee on Agriculture and Rural Development (TCARD) meeting.
- Comments on draft MoU between Bangladesh and Tanzania and sent to MoA.
- Input provided for Foreign Office Consultation between Bangladesh and Germany and sent to MoA.
- Comments of BARC sent to MoA on the Guidelines for the Environmental Risk Assessment (ERA) of Genetically Engineered Plants.
- Comments of BARC sent to MoA on the MoU of Bangladesh and Bruinai.
- Comments on MoU between Bangladesh and Lithuania was prepared and sent to MoA
- Input regarding Foreign Office Consultation (FOC) between Bangladesh and Turkey and sent to MoA.
- Organized meeting on Wheat Blast incidence in Bangladesh and its way forward in collaboration of national and international and proceedings sent to MoA.
- Input provided to MoA regarding declaration of CIMMYT as International Organization as per ERD requirement.
- MoU between BAU-BINA was reviewed and comments was made and sent to MoA.
- Draft MoU between Bangladesh and Lithuania was corrected and sent to MoA.

- Draft MoU between Bangladesh and South Africa was corrected on the basis of comments of ERD, Investment Board and MoFA and sent to MoA.
- Comments sent to MoA on Bangladesh-German Consultation 2016.
- Prepared draft Material Transfer Agreement (MTA) for sharing genetic material among AFACI countries and sent to MoA.
- Input provided to MoA regarding South-South Cooperation and sent to MoA.
- Input provided on Bangladesh Agricultural Research and development for presenting to 11th ASEM Summit during 15-16 July 2016 at Ulaanbaatar, Mongolia and sent to MoA.
- Input provided for Foreign Office Consultation between Bangladesh and Nepal for enhancing agricultural cooperation and sent to MoA.
- Input provided for draft MoU of ABSP II between Bangladesh and Cornell University which is renamed as FtFSAEIF and sent to MoA.
- Prepared BARC comments regarding proposal on Technical cooperation Treaty between Bangladesh and Columbia and sent to MoA.
- Prepared BARC comments on minutes of the Inter-ministerial meeting on “Framework Agreement between the Government of the Kingdom of Denmark and the Government of the People’s Republic of Bangladesh regarding Bangladesh Country Programme (2016-21) and sent to MoA.
- Material Transfer Agreement signed between AFACI and BARC during the 4th AFACI General Assembly in Colombo, Sri Lanka May 2016.

Regional and International Collaboration & Cooperation

(i) The BIMSTEC workshop on Developing Good Agricultural Practices (GAP)-Phase II “GAP for International Trade”

Technical Report on Developing Good Agricultural Practices (GAP) was delivered by Dr. Mian Sayeed Hassan, Chief Scientific Officer (Crops) & Director, TTMU, BARC in the workshop. Following discussions were taken in the workshop:

- All Member States to submit a comprehensive paper (7-10 pages) on GAP Experiences latest by 30 November

2016 to the Lead Country, Thailand and the BIMSTEC Secretariat, so that the Secretariat in collaboration with the Royal Thai Government could publish them in its Website in Celebration of 20th Anniversary of the BIMSTEC.

- It was unanimously agreed upon by the Delegates present in the Workshop that further decision on cooperation in Good Agricultural Practices (GAP) among the BIMSTEC Member States be taken up at the 5th Meeting of the BIMSTEC Expert Group on Agricultural Cooperation.

Some important activities and policy support by crops division are as follows:

- Evaluation of proposal for Contained Research work of GM rice of DU conduct at BRRI. Proceedings sent to the MoA.
- Evaluation of the proposal of ACI Ltd. for the permission of seed production and marketing of Bt Brinjal. Proceedings sent to the MoA.
- According to the decision of the National Technical Core committee Meeting (NTCCB) held in 27 Aug 2015, the Advanced Seed Research and Biotechnology Centre (ASRBC) of ACI has visited on 13 September 2015 to observe developed facility for genetic engineering research. The members of NTCCB core group and co-opt expert members from BARI, BRRI and Department of Environment were present on that visiting team. Report was prepared based on the comments and opinion of the team members and sent to MoA.
- The proposal of BARI for releasing Bt brinjal as variety BARI Bt begun-5, 6 and 7 was evaluated by NTCCB core group on 22 September 2015. The proceeding sent to the MoA.
- The proposal of Mahyco, Bangladesh Private Ltd. for importing Bt brinjal hybrid (F₁) seed and conduction of field trial was evaluated by NTCCB core group on 22 September 2015. The proceeding sent to the MoA
- The proposal of BRRI for conducting Confined Field Trial (CFT) of Pro-vitamin rich Golden Rice event GR2-E BRRI dhan29. The proceeding of the meeting sent to the MoA.
- The proposal of CDB regarding import of Bt cotton 8 variety Bollgard II (BG II) from Mahyco and conduct contained trial at BARI

was evaluated by National Technical Committee on Crop Biotechnology (NTCCB) core group. The proceeding sent to the MoA.

- Participated in the 101st to 103rd Sub-PTAC Meeting held at AIS, DAE, Khamarbari, Dhaka
- Participated in the 80th meeting of Technical Committee, National Seed Board held at BARC
- Proposal of BARC was prepared on “Scientific basis and protocol to be followed during issuance of License for Pesticides” and sent to MoA.
- Prepared comments on draft proposal of Seed Policy 2016 and sent to MoA.

Reporting on National Issues

(i) Reporting on the status of river siltation, water stagnation and effect of salinity in the cultivable land of Barguna district

Dr. Mian Sayeed Hassan, Chief Scientific Officer (Crops) & Director, TTMU, BARC as a team leader visited to Barguna district for monitoring and evaluation the status of river siltation, water stagnation and effect of salinity in the cultivable land. The visit was held during 19-22 December 2015 with 10 members multidisciplinary team comprising from BARC, BARI, BRRI, BFRI (Fish), DAE, Water development board etc. This activity was done according to a letter from ministry of agriculture regarding the issue. After



visiting the location including both river estuary and upland, report sent to ministry of agriculture describing the present situation of river siltation, salinity, polder management and salinity levels that affecting present and future agriculture productivity.

Technology Transfer Monitoring Unit

TTMU is working to facilitate swiftly transfer of technologies generated by the National Agricultural Research System (NARS) to Department of Extension (DAE), private and public organizations, Non-Government Organizations (NGO) etc. TTMU is also coordinating to strengthen the linkages among research, extension and farmers. In respect to the above mentioned background and in accordance with the Work-plan 2015-16 (July’ 2015-June’ 2016), TTMU has organized one training programme at Rangpur, conducted seven meetings at BARC, Dhaka and published one technology book. TTMU also prepared a



report on *Agro Technology Park* of Shyamnagar,



Satkhira. Besides, the unit prepared annual progress and workplan 2015-16, monitoring and other reports on NATCC, TTSC etc. The details activities conducted by TTMU during 2015-16 have described below:

Monitoring, reviewing and evaluation report of programs/activities of NARS Institutes

Dr. Fauzia Yasmin, PSO, TTMU participated as member in the field monitoring of research activities of NARS institutes, BARC funded core research grand programme. The team visited 9 sub-projects during 23-25 March 2016 at BINA, BAU and BARI (Mymensingh site). Monitoring and Evaluation report

of programmes/activities of NARS institutes has submitted to planning and Evaluation division.

Training on Location specific transferable technologies for sustainable food security: Rangpur and Dinajpur region for Agriculture Officers, DAE

A training programme on *Location specific transferable technologies for sustainable food security: Rangpur and Dinajpur region for Agriculture Officers, DAE* was organized by TTMU, BARC on 30-31 May 2015 at BARI, Alamnagar, Rangpur. The objective of the training programme was to transfer of location specific new technologies suitable for the region. Forty Officers of DAE from Rangpur and Dinajpur regions covering eight districts viz., Rangpur, Gaibandha, Kurigram, Nilphamari, Lalmonirhat, Dinajpur, Thakurgonj, Panchagor. Specialized scientists of BARI and BARC delivered lectures on production techniques, pest management and post-harvest management of rice, wheat, maize, pulse, oilseed and Good Agricultural Practices (GAP) for fruits and vegetable production and nutrient management for these regions. In the inaugural session of the training Dr. Md. Abdus Sattar, Chief Scientific Officer (Soil), NRM, BARC was the Chief Guest. Mr. S M Asraf Ali, Deputy Director, DAE, Dinajpur was the Special Guest, Mrs. Selina Hassan, Senior Scientific Officer, BARI, Rangpur was the guest of honour. Dr. Mian Sayeed Hassan, Director (TTMU), BARC and course Director of training programme presided over the inaugural session. At certificate giving participant expressed their highest gratitude to BARC for organizing this type of useful training. They have requested to conduct similar training programme to other regions.

Feasibility Study of Floating Agriculture: Feasibility Study of the project entitled *Improvement of Indigenous Floating Agriculture System in Bangladesh* has been submitted by the Bangladesh Agricultural Research Institute (BARI) to improve the indigenous floating agriculture system towards increasing the production of vegetable and spice crops under flooded/submerged ecosystems of Bangladesh. Director (TTMU), Bangladesh Agricultural Research Council selected Convener of the Feasibility Study Committee

of the project. Director (TTMU) done the feasibility study of the project and submitted by April 2016.

Reporting on Agro Technological Park

The standing committee of parliament on Agriculture



A view of Agro-technology Park at Shyamnagar, Satkhira

visited Sidor and Iela disaster area of Satkhira, Bagerhat and Jessore as well as visited the Agro-technology Park established at Shamnagar. The standing committee advised to replicate the theme Shamnagar Agro-technology Park to the other Upazilla of the country. Accordingly Ministry of Agriculture requested BARC to make a comprehensive report on the Agro-technology Park by visiting the spot. BARC made a committee headed by Dr. Mian Sayeed Hassan, Director (TTMU), with Dr. Fauzia Yasmin, PSO (TTMU), BARC as member secretary with six other members from BARI, DAE, and local DAE and Uzazilla Administration. The Committee visited Shamnagar, Satkhira during 12-13 May 2015.

National Agricultural Technology Coordination Committee (NATCC) revived

Technology transfer and dissemination activities through NATCC were stopped since 2008 due to various regions. Initiatives have been taken to restart the NATCC including regional, district and Upazilla level. TTMU started to review the scope for restart the NATCC activities through organizing meetings with DAE, BADC, NARS and ministry concerns scientists and officers to review the situation of the technology transfer status and After cordial initiation, Director TTMU organized 4 meeting of NATCC on 31 January,

20 April, 03 November, 28 December 2015 and 04 May 2016 and Dr. Abul Kalam Azad, Executive Chairman, BARC presided over the meetings.

Strengthening Technology Transfer activities

To disseminate the newly released varietal and non varietal technologies by NARS institutes properly and quickly to the farmers, it necessitates some strategies, techniques or methods. On this background, TTMU organized Technology Transfer Strengthening Committee (TTSC) meeting on 13 August 2015 and 18 February 2016 and Dr. Abul Kalam Azad, Executive Chairman, BARC presided over the meetings. To strengthening the activities of transferring technologies, a committee has made comprising senior scientists of NARS (BARI, BINA, BRRI, BJRI, BFRI, BLRI), BADC, DAE, BARC as members. Dr. Jibon Krishna Biswas, Ex Director General, BRRI, Gazipur was the President and Director, TTMU was the Member-secretary of this committee. Preparation of a report on strengthening the activities of transferring technologies is being under process.

Distribution of Mother tree

NARS institutes have generated many varieties of fruits which should be made available to the farmers and others. To disseminate these mother trees of fruit varieties all over the country, BARC arranged meetings to distribute saplings by BARI at Horticulture Centre, DAE and Horticulture Development Centers, BADC. TTMU organized two meetings on fruits mother tree saplings distribution on 17 August 2015 and 08 September 2015 which were presided over by the Executive Chairman, BARC. Around 2000 fruits saplings of 21 varieties were distributed by BARI to 73 and 23 Horticultural Centers of DAE and BADC respectively on 12 September 2015.

Attended Workshop, Training, Seminar, Meeting etc.

During July 2015 to June 2016, Officers of TTMU has attended a good number of workshops, seminars and meetings in home and abroad organized by NARS

institutes and other agencies. During period, Dr. F. Yasmin DAE and funded by GOB-DANIDA. PSO (TTMU) has attended 3-day *National Conference on Enhancing the Role of Mass Media Practitioners in knowledge transfer to Improve Agricultural Productivity* during 22-24 September 2015 organized by National Productivity Organization and Asian Productivity Organization, and *Consultation Meeting on Adaptive Research in IFMC* in September 2015 organized by DAE and funded by GOB-DANIDA.

National and international Linkage

TTMU maintained a strong linkage with MoA, DAE, BADC, SCA, HORTEX Foundation, KGF etc.

Worked as member in the different committees

Director, TTMU has been nominated as the publication secretary of the BAEN executive committee and worked in the committee for the development of the constitution of Bangladesh Agricultural Extension Network (BAEN). He also worked as member in the Technology Transfer Strengthening, and Technology Transfer and Dissemination Committee.

PLANNING AND EVALUATION

A. Project development/Project financing

At the end of National Agricultural Technology Project (NATP) Phase-1, Bangladesh Agricultural Research Council (BARC) is going prepare the Phase-II project in this aspect a Technical Project Proposal (TPP) namely *National Agricultural Technology Project (NATP) II: Preparation Facility* was developed. The period of the TPP was ended on September 2015. During the period of TPP, DPP for NATP II was developed and its activities were started from October 2016. Now the preliminary activities like invitation of project proposal and recruitment of contractual staff and consultants are under process.

A Preliminary Development Project Proposal (PDPP) titled *Strengthening of Bangladesh Agricultural Research Council* is under preparation by Planning and Evaluation Division and it will be submitted to Planning Commission, Ministry of Planning very soon. Another Development Project Proposal (DPP) titled "Introduction of Commercial Seaweed Cultivation in the Coastlines of Bangladesh" is in preparing stage and

concept notes of both projects were listed in green page ADP in 2016-17 fiscal year.

B. Project Implementation

To facilitate research and technology transfer activities, the Bangladesh Agricultural Research Council is regularly providing research grants to various public organizations since 2004. During the fiscal year 2015-16 the Planning and Evaluation coordinated 33 research and technology transfer programmes of the NARS and Agricultural Universities through funding to the core research and human resource development activities. Further, the Planning and Evaluation division organized frequent review and desk/field monitoring activities for their proper implementation. With the approval of the Executive Council of BARC, an amount of Taka 140.00 lakhs was provided under core research programmes. The research results of the ongoing projects under Research Grant during 2015-16 implemented by different organizations are briefly described below:

Bangladesh Agricultural Research Institute (BARI)

Quality seed/propagule production and dissemination of BARI released flower varieties in Bangladesh: Mutations are induced in different crops to create variability for further improvement. In vegetatively propagated flower plants, mutation breeding offers great potentialities as the mutated part can be conveniently perpetuated by vegetative means resulting in the development of new forms. The effects of gamma rays on flowers have been studied by several workers in abroad but no varieties have been developed through gamma radiations in Bangladesh. Hence, in the present investigation, emphasis was laid on finding out variations caused by gamma radiations in morphological characters including colour variations. Gladiolus is highly heterozygous in its genetic constitution which makes it promising test material for inducing physical mutagenesis. Therefore, an experiment was carried out at Floriculture Farm of HRC, BARI, Gazipur during 2015-2016 to develop variety by fixing the induced variation in succeeding generations. Two gladiolus varieties [BARI Gladiolus-5 (V₁) and BARI Gladiolus-6 (V₂)] and one gladiolus genotype (GL-011) (V₃) were considered as one factor and the other factor was gamma radiation with six levels [40 Gray (R₁), 60 Gray (R₂), 80 Gray (R₃), 100 Gray (R₄), 120 Gray (R₅) and control (R₆)]. At 60 and 80gray radiation BARI Gladiolus-6 and GL-011 produced highest number of corm and showed some

changes in petal colour. A trial was conducted at Gazipur, Rajshahi, Bogra, Rangpur and Jessore during 2015-2016 to evaluate the performance of gladiolus varieties and to popularize among the farmers. All BARI Gladiolus varieties showed better performance and produced higher yield at all locations than BARI Gladiolus-1. The demand of BARI Gladiolus-3 and BARI Gladiolus-5 was more in Gazipur, Rajshahi and Bogra. But the demand of BARI Gladiolus-3 and BARI Gladiolus-4 were more in Rangpur and Jessore. Trials on BARI Tuberose-1 with promising line (PT-001) as check were conducted at Gazipur, Rajshahi, Bogra, Rangpur and Jessore to evaluate the performance of tuberose varieties and to popularize among the farmers. The crops grown in the farmer's field are now satisfactory stage in all location. Farmers were very much interested to cultivate BARI Tuberose variety due to long vase life, sweet scent, higher yield potentiality and economic profit. Now a days Marigold gained popularity amongst flower growers on account of its easy culture and wide adaptability. Therefore, demnostrial trials also conducted in the same location on BARI Marigold-1 with check to evaluate the performance of marigold and to popularize among the farmers. Farmers are inland on cultivation of BARI Marigold-1 due to it's higher yield potentiality and better market price over local variety. They preferred BARI Marigold-1 variety that there was no incidence of disease and insect in this variety.

Organic Amendments in Mungbean-T.Aus-T.Aman Cropping Pattern for Sustaining the Yields and Soil Fertility in Southern Region of Bangladesh: The project has been conducted at Babugonj upazila of Barisal and Bhola sadar of Bhola districts during 2015-2016 cropping season. In each upazila, 10 farmers were selected for implemented the project work. Each demonstration consists of INM (Integrated Nutrient Management) and Farmer's practice. 1st crop Mungbean (cv. BARI Mung 6) was sown on 13 January to 20 January 2015 and harvested at 70 and 81 DAE. The highest seed yield 1641 kg/ha was recorded from Babugonj, Barisal from the INM package. In Bhola, seed yield ranged from 1120 to 1527 t/ha. Mungbean biomass (4.02 to 8.42 t/ha) was incorporated into the experimental soil. Second crop T. aus rice (BRRI dhan 48) was transplanted at 15-20 May, 2015. The highest seed yield (4.25 t/ha) was recorded from Bhola sadar from INM package followed by INM package at Babugonj, Barisal (4.04 t/ha) and the lowest (3.25 t/ha) at farmer's practice in Babugonj, Barisal. In case of T. aman rice (BRRI dhan 62, the maximum seed yield

(5.12 t/ha) was recorded from Babugonj from the INM package followed by INM package at Bhola sadar (4.62 t/ha) and the lowest (3.90 t/ha) at farmer's practice in Bhola sadar. The highest rice equivalent yield (15.73 t/ha), gross return (3,14,600 Tk./ha), net return (2,05,220 Tk./ha) and BCR (2.88) were recorded from Babugonj, Barisal.

Adaptive Trials on newly Developed Improved Varieties of Aroids at Farmers Level: The adaptive trials were conducted with the objectives to disseminate the promising varieties of aroids at different Agro-ecological zones of Bangladesh as well as to increase the area, yield and production of aroids and to increase farmers' benefit by growing promising varieties. Five varieties of at different Agro-ecological zones of Bangladesh as well as to increase the area, yield and production of aroids and to increase farmers' benefit by growing promising varieties. Five varieties of panikachu, namely BARI *panikachu*-1, BARI *panikachu*-2, BARI *panikachu*-3, BARI *panikachu*-4 and BARI *panikachu*-5 and one *mukhikachu* variety BARI *mukhikachu*-2 with local varieties were considered in the trial. The farmers were selected through OFRD, BARI and DAE personnel in the respective areas. Seed cormels of *mukhikachu* and suckers of *panikachu* were supplied to the farmers during the crop season. Each farmer was advised to cultivate all the supplied varieties along with local check. During 2015-16, the crops are in vegetative stage. The stolons of panikachu has been harvested for 2-3 installments, but rhizomes were remained. The stolon weight per plant varied from 120 g to 240 g. The cormels will be harvested after maturity.

Development of fertilizer package for four crop based cropping pattern in rice based cropping system: Six field experiments with cropping patterns CP₁ = Mustard – Boro – T. Aus – T. Aman at Gazipur and Jessore, CP₂ = Potato – Boro – T. Aus – T. Aman at Bogra and Rajbari, Dinajpur and CP₃ = Mustard – Mungbean – T. Aus – T. Aman at Rajshahi and Barisal was initiated from July 2014. The cropping pattern actually started from rabi crops after timely harvest of T.aman rice and fertilizer treatment was incorporated from the rabi crops (upland crops). For development of fertilizer package for four crop based cropping pattern in rice base cropping system the three cropping patterns were tested. There were Eight different treatments viz. T₁ 100 NPKS_N (STB), T₂: T₁+ 25% N, T₃: T₁ + 25% NP T₄: T₁+25% NK, T₅: T₁+ 25% PK, T₆: T₁+ 25% NPK, T₇: 75% of T₁ T₈: Native nutrient were. The

experiment was laid out in RCB design with three reflections. The results obtained at different locations indicated that the yield of mustard (BARI Sarisha-14), potato (Diamont) and boro (BRRI dhan28), mungbean (BARI Mung-6), T. aus (Parija) and T. aman (BINA dhan-7) was statistically influenced by the fertilizer treatments. The highest yield was obtained from the T₆ treatment where 25% additional NPK was added over the 100% STB rate in all the locations. The result revealed that fertilizer dose T₆ (25% additional NPK was added with the 100% STB rates) would be optimum for higher yield and yield contributing characters of the four crop based cropping pattern.

Dissemination of BARI Developed Promising Vegetable and fruit varieties at Bogra: The study was conducted using proposed vegetable and fruits crops and their varieties to study the adaptability at Sonatola Upazila of Bogra district during late winter/early summer-2015 onward (reporting July 2015-June 2016). The selected crops for this year were: red amaranth, stem amaranth, shabuj danta shak, kang kong, Indian spinach and in summer season crops are included: okra, snake gourd, ridge gourd and bitter gourd and bottle gourd, in winter season crops were: tomato, brinjal, garden pea, french bean and bottle gourd. Fruit crops viz: mango, papaya, guava, banana, pumelo and jujube while, company or local variety of vegetable was used as check to make comparison. According to base line survey farmers were trained in light to improve awareness and knowledge on modern vegetables and fruit production techniques. The findings revealed that most of the BARI released vegetable varieties were contributed higher yield compared to control to its better genetic potentiality and wide range of adaptability. Several vegetables and their varieties like; BARI tomato 14, BARI lau 4 (summer), french bean have become popular in that area. Initially, patterns of vegetable consumption, distribution and sells couldn't quantify. Now farmers are consuming more than 20% produced vegetables, almost 8% vegetable are being distributed among relatives and neighbor. Finally, more than 70% vegetables are being sold by the farmers which helped farmer to improve their livelihood. The planted fruit crops are in vegetative stage. In respect of financial expenditure achievement is 99.75%.

Propagule/Seedling production and dissemination of BARI released fruit varieties for increased quality fruit production: A project entitled 'Propagules/Saplings production and dissemination of BARI released promising fruit varieties has been

carrying out at the Pomology Division, Horticulture Research Centre, BARI, Gazipur since July 2014 in order to produce good quality propagules/saplings of BARI developed promising fruit varieties and disseminate those varieties to the fruit growers/farmers. In 2015, saplings of mango (BARI Aam-2, 3, 4, 8), litchi (BARI Lichu-2, 3), pummelo (BARI Batabilebu-3, 4), sweet orange (BARI Malta-1), sapota (BARI Safeda-3), aonla (BARI Amloki-1), wax jumbo (BARI Jamrul-1) and longan (BARI Anshfall-2) were distributed among the fruit growers in the Aliar Chala village under Kaliakoir upazilla of Gazipur district and those were immediately planted. At the same time, 30 fruit growers of Enaetpur village under Fulbaria upazilla of Mymensingh were also supplied same type of fruit saplings of BARI released promising fruit varieties. Condition of the saplings planted in the orchard was observed to be good. Some fruit trees were found to produce flower but for the better growth and development flower panicle were removed.

Development of a mechanical vegetable washing machine: Based on the base line information, a mechanical vegetable washing machine was designed and fabricated with locally available materials at Farm Machinery & Postharvest Process Engineering Division, Bangladesh Agricultural Research Institute, Gazipur in 2015-2016 to clean the vegetables with less cost and quickly. Overall dimension of the machine is 3759 mm × 1473 mm × 1676 mm. It was made of two units on the basis of vegetables types. One was for leafy and fruit vegetables and another one was for root vegetables. Main parts of the leafy and fruit vegetables unit were such as trapezoidal type water tank; mesh type conveyer; power transmission system; water supply system; and trays. Main parts of the root vegetables unit are such as chassis; brush type roller; power transmission system and water supply system. Both the conveyer net and brush roller were operated by an electric motor of 1.1 kW. The water was flown through the pipe by centrifugal water pump of 1.1 kW. Washing time for fruit, leafy vegetables were 32 second and ranged from 2 to 3 minutes for root crops depending on the amount of dirt of surface of the vegetables. Water requirement for washing vegetables was 3-5 t/h. The capacities of the machine were ranged from 1 to 2 t/h for leafy, fruit vegetables and 0.5 t/h for root vegetables. The cleaning efficiency was about 98%. Considering unique machine for all kinds of vegetable, washing cost was 0.16 Tk/kg. For considering individual unit of the machine for leafy and fruit vegetable unit, washing cost was found to be 0.13

Tk./kg and 0.41 Tk./kg for root vegetables unit. Payback periods and breakeven points were 21 days and 93 h/yr, respectively. Benefit cost ratio (BCR) of the machine was 3.7. Weight of the vegetable washing machine is 646 kg. The price of the machine is about 250,000Taka (US\$ 3205). Farmers and traders would be benefited using the washing machine in custom hire basis at the rate of Tk 0.75-1.00 per kilogram of vegetable.

Impact of Hybrid Rice and Maize Seed in Cereal Production System in Bangladesh: The study was undertaken on marketing scenario, farmers' perception and efficiency of hybrid rice and maize producers in Bangladesh. Data of 400 farmers and 40 seed dealers were collected from purposively selected four districts such as Dinajpur, Sherpur, Gopalganj and Noakhali. Ten leading seed companies were also included in the study. Area under hybrid rice was slightly decreased and growth rate was negative (-0.025) from 2007-08 to 2015-16. Area under HYV rice was slightly increased and growth rate was positive (0.017) in the same period. About four thousand tons of hybrid rice seed were imported by the leading 10 seed companies during 2015-16 which was about 38% of total import of hybrid rice seeds. BADC is the main hybrid seed producer (HL 8 h) in Bangladesh and it can meet up only 10% of total demand. Twelve to twenty-seven hybrid rice varieties were found in the study districts. Gopalganj sadar, Gopalganj covered highest area with hybrid rice (13813 ha), followed by Soaimuri, Noakhali (7200 ha); Sherpur Sadar, Sherpur (6680 ha) and Goraghat, Dinajpur (1490 ha). Farmers moderately agreed that quality of hybrid rice seed was good and provide higher yield but seed price was higher and grain price was lower. Farmer's gross return and gross margin were increased by using hybrid rice seed compared to HYV seed. Farmer's gross margin was found to increase 22-28% in hybrid rice over HYV in different locations. The linear programming model shows that area under HYV rice has been shifted to hybrid rice about 8 to 52 percent. The stochastic frontier production model indicated that inefficiency effects were present in hybrid rice and maize production. Hence, technical inefficiency effects have significant impact on output. These results suggest that there is a substantial scope for increasing rice production in the country using hybrid seeds. Farmers are happy by producing hybrid rice as it is higher yielder.

Development of Geodatabase for Haor Region for Sustainable Intensification of Agriculture: The study

was conducting for the development of Geodatabase of the Haor Region located in the northeastern part of Bangladesh for sustainable intensification of Agriculture. Scopes of this research include accumulation of existing geodatabase of Haor region from different sources or organizations, adding values to them, conduct new analysis and generate geospatial data from satellite imagery. To procure relevant geodata from a wide range of public/autonomous organizations including Department of Bangladesh Haor and Wetland Development, Center for Environmental and Geographic Information Services, Bangladesh Water Development Board, Institute of Water Modeling, Local Government Engineering Department, Soil Resources Development Institute, Bangladesh Agricultural Research Council, Survey of Bangladesh were approached. Some of the organizations responded positively and shared or in process to share geodata from their repository. However, most of the available geodata are not up-to-date and are of coarse spatial resolution. To generate up-to-date and of moderate spatial resolution landuse and cover map, landsat 8 multi-spectral satellite data of Rabi season was classified. Extensive ground survey was conducted to accumulate primary reference data for training of classification algorithms as well as validation of classification results. Fallow kanda lands were successfully identified for a certain instance from the initial classification of landsat 8 satellite image.

Information of BARI technology at farmer's doorstep through Mobile Apps: A mobile app named BARI application *ÒK...wl cÖhyw³ fvÛviÓ* was developed to make available crop production packages at the right time at farmer's doorstep in a cost effective way. The entire contents of this app are in Bangla language. BARI apps *ÒK...wl cÖhyw³ fvÛviÓ* has five options namely (i) Crops (dmj), (ii) Other technology (Ab"vb" cÖhyw³), (iii) Query (cÖkœ Kiæb), (iv) Answer (DËi/gZvgZ) and (v) Communication (‡hvMv‡hvM). At present about 1000 technologies hosted in the mobile apps which included oilseed crops, pulse crops, tuber crops, wheat, maize, fruits, vegetables, flower, spices crops, rice, jutes, cotton and sugarcane, etc. Any farmer can ask/inquire about related technology through query option. Answers of the queries are sent to farmer through SMS and e-mail. Answers are also stored in the feedback option which is open for public access. The farmer can directly contact with related specialists through communication option. Mobile apps *ÒK...wl cÖhyw³ fvÛviÓ* is regularly updated with maintenance and newly developed

technologies are added as well. This apps can be downloaded from Google play store and Windows store using Android and Windows phone respectively. This apps can be used offline. The apps can also be shared with other Android based mobile phones using SHARE it apps even without internet.

Collection, conservation, characterization and evaluation of underutilized fruits in Chittagong Hill Tracts:

A approved project collection, conservation, characterization and evaluation of underutilized fruits in Chittagong Hill Tracts under Research Grant of BARC was conducted at the Hill Agricultural Research Station, Raikhali, Rangamati Hill district during 2015-16 with the objective of collect, evaluated and characterization of endangered minor fruits in Chittagong Hil Tracts. A survey work is completed in Rangamati and Bandarban Hill Districts as well as other places and till now collected total 67 (sixty seven) germplasm on nine minor fruits like Pummelo, Bael, Mandarin, Santol, Plum, Peach, Rokto gola, Jhinuk badam and Aingchi gola. Most of them are already transplanted in the research field of HARS, Raikhali, Rangamati which are in growth condition. Established minor fruits germplasm block containing about fifty species of minor fruits are mostly flowering and bearing stage in the field among them evaluation of some minor fruits like exotic date palm, grape, jamun, star gooseberry, bael, wood apple, phalsa and cultural management works are also going on the existing established minor fruits orchard.

Development of Population for Gynodioecious Papaya Variety:

A study on Development of gynodioecious population for obtaining 100% productive plants with a view to increase farm income through papaya cultivation was carried out at the Fruit Research Farm of Pomology Division of HRC, BARI, Gazipur during the period from December 14 to Novemebr 2015. Three sets of plants namely S₂ progeny of CP Joy-005, CP Joy-009 and BC₁ progeny were included in the study. Among the three sets S₂ progeny of CP Joy-005 produced 44.8, 43.1 & 12 percent andromonoecious, female and male plants respectively; S₂ progeny of CP Joy-009 produced 30, 51 & 18 percent andromonoecious, female and male plants and the BC₁ progeny produced 7.2, 39.3 & 53.6 percent andromonoecious, female and male plants respectively. Considering the number of fruits per plants, 32, 26 & 37 fruits were recorded in CP Joy-005, CP Joy-009 and BC₁ respectively. Fruits of S₂ progenies showed bright yellow flesh colour but in BC₁

it was light pink to red colour. TSS (%) of fruits were 11.0, 13.0 & 12.0 in CP Joy-005, CP Joy-009 and BC₁ respectively.

Bangladesh Rice Research Institute (BRRI)

Evaluation of advance breeding lines for the development of heat tolerant rice: An experiment was conducted to evaluate the breeding lines of rice to develop a high temperature tolerant rice variety. Besides this some rice germplasm were screened out to identify high temperature tolerant genotype which can be used as donor parent. Ten BRRI breeding lines (BC1F2), eight IRRI breeding lines and 110 genotypes were evaluated. Twenty to twenty five days seedlings were transplanted in earthen pot which were filled with soil. The experiment was conducted in completely randomized design. The plants were fertilized and intercultural operations were done when necessary. All pots were placed in natural condition until heading with BRRI recommended management practices. During heading 3 pots from each genotype were placed in controlled glass house at high temperature ($35\pm 3^{\circ}\text{C}$) and high humidity ($75\pm 5\%$) for seven days. After that the pots were moved to natural condition. At harvest floret fertility and physiological traits for the plants were examined. Among the BRRI breeding line nine entries showed 38 to 50% fertility under heat stress treatment and got SES score 5. These lines will be grown in the field for yield and phenotypic acceptability. Among the BRRI germplasm 34 got score 5 and 7 got 3. Among the IRRI breeding lines one scored 3 and 4 scored 3.

Tracking Climate Resilient Rice varieties Development by BRRI and Its Economic Performances at the farm Level in Bangladesh: This study was undertaken to evaluate the adoption status, yield and cost/benefit ratio of BRRI developed stress tolerant rice varieties for different stress prone environments in Bangladesh under changing climatic condition. The study period was July/2014 to June/2017 and the locations of the study were Satkhira, Patuakhali, Khulna and Bagerhat districts under Saline prone area; Rangpur, Kurigram, Lalmonirhat and Gaibandha under Submergence prone. Locations of the drought prone areas were Natore, Rajshahi and Chapai Nawabgonj districts. Total sample size was 650 respondents in different seasons. In addition, information from DAE was collected by personal visit. Focus group discussions (FGD) following face to face interview method were followed to collect information. Data of

Aus, Aman and Boro season of 2015 has been collected and analyzed. The findings of partial analysis revealed that due to unavailability of suitable stress tolerant varieties' seed in the stress prone areas, adoption rate of these varieties were very lower compared to non-stressed varieties. Profitability analysis revealed that although Boro growers in saline prone area obtained higher yield, consequently higher gross return; but finally net return was negative as their variable and total costs were higher. Similarly, benefit cost ratio (BCR on cash cost basis) of Aus season in drought prone areas were negative. Benefit cost ratio (on cash cost basis) of Aman paddy in all stressed condition was marginally positive. It might be due to better market price of the product and lower cost of production. So, it gets popularity in submergence prone areas. Yield of all stress tolerant rice varieties in all the seasons were lower compared to non stress tolerant varieties which discouraged the growers to adopt these varieties. Furthermore, farmers' attitude is not to sacrifice yield compared to existing popular varieties. So, they take risk and cultivate non stressed popular varieties as chance crop; thinking that if there are no hazards of climate change, they might reap better return from non-stress tolerant modern varieties in terms of higher yield. So, it is essential to introgress specific gene for particular stress to the popular high yielding varieties in order to remain the yield level at par. Besides, extension program should be strengthened to the diffusion and popularize these varieties at the field level.

Bangladesh Jute Research Institute (BJRI)

Development and Popularization of value added diversified blended product: Bangladesh is the largest producer of jute fibre in the world. But now-a-days jute is facing tough competition with synthetic fibres. For the survival of jute, it is necessary to diversify the uses of jute and develop new products by blending jute with cotton and native sheep wool. It is now common practice to blend two or more fibers together in order to produce yarns or fabrics with required properties. Blending of jute with other fibres (Such as cotton, native sheep wool, silk, viscose Rayon, Jute-cell, wood-cell etc.) may be considered as an alternative and possible diversified uses of jute yarns and fabrics. Jute fibre can be blended with cotton, native sheep wool and blended fabrics could be used as shirting, suiting, terry towel and for other upholstery purposes. Because of its great abundance and shortage of cotton, jute is blended with cotton and jute cotton-blended yarns are manufactured mainly to take advantages of the lower

price of jute fibre. Jute is blended with cotton and natural fiber and the blended yarns are used for production of blended value added fabrics. For this reason quality jute-cotton and native sheep wool blended yarn is required. To produce value added diversified product. Hence, Jute cotton blended value added products viz. sample of shirting & suiting has produced under this Core-program.

Bangladesh Institute of Nuclear Agriculture (BINA)

Development of Onion, Ginger and garlic mutant varieties through induced mutation: To collect local and exotic germplasm of onion, garlic and ginger for developing desirable mutants with high yield potential, good aroma and flavor through nuclear techniques. Twelve genotypes of Zinger, nine accessions of Onion and five genotypes of Garlic were used in the study. Seeds of onion, garlic (clove) and ginger (Rhizome) were irradiated by gamma ray for the test of radio-sensitivity, Radio sensitivity test was conducted to estimate LD₅₀ and GR₅₀ for the highest mutation induction of the genotypes of onion, zinger and garlic. The seeds, cloves and rhizomes were irradiated with gamma rays with the help of ⁶⁰Co irradiator at BINA, Mymensingh. Growth reduction at 50% was estimated from the reduction of seedling height (%) (compared to control) graph and found the value 3.00 Gy for BAURasun-1, 2.5 Gy for BAURasun-2, 2.6 Gy for BAURasun-3 and 2.1 Gy for AC-5. In case of Zinger genotypes, growth reduction of 50% was estimated 2.0 to 3.0 Gy for getting highest frequency of mutation. (Fig. 1-6) Seedling height reduction showed significant decrease with increase in applied doses of gamma rays for all the tested genotypes of garlic (Fig 1-5). The M₁ populations and the check (Mother) variety differed for yield and yield attributes (Table 1-5). The yield of 9 M₁ populations of BAURsasun-1, 14 M₁ populations of BAURasun-2, 12 M₁ populations of BAURasun-3, 14 M₁ populations of BAURasun-4 and 9 populations of AC-5 was observed higher yield than the mother check.

Soil Resource Development Institute (SRDI)

Introduction of Quesungual Slash and Mulch Agro forestry System (QSMAS)- an eco-efficient method of enhancing crop yields and soil quality in Chittagong Hill Tracts: The Chittagong Hill Tracts region is of great importance for growing various crops, which are different from the plants. Farmers practice traditional Jhum cultivation which contributes to soil and nutrient loss. It can also lead to land degradation if

population pressure reduces the follow periods needed for the recovery of natural resources. A Questionnaire based survey in six Upazilas of Bandarban revealed that the hill dwellers are logging behind in education, forming knowledge, access to information on modern culture, inputs and loan facilities. As such they could seldom produce enough food for their consumption. The Quesungual Slash and Mulch Agro-forestry System (QSMAS) is a small holder production system with a group of techniques for the sustainable management of vegetation, soil and water resources in drought-prone hillside. The system was developed in the early 1990s in close collaboration with farmers and technicians from FAO and other institutions, as an alternative to traditional and widespread slash and burn agriculture. The present research work was undertaken to introduce an eco-friendly productive crop production system in sloping lands of CHT which will mitigate the process of land degradation due to Jhum culture as well as take care of food security of Hill people. The experiment was conducted in moderate hill slope of Soil Conservation and Watershed Management Centre, SRDI, Bandarban. Experimental site comprised of four plots- QSMAS model, modern Jhum with mulch, transitional Jhum and control (secondary forest). It was observed that system productivity of QSMAS was much higher than that of Jhum with hedge row and traditional Jhum. Total soil loss and surface run off was much lower in QSMAS model than Jhum with hedge row and traditional Jhum.

Cotton Development Board (CDB)

Bioefficacy Evaluation of Different Botanical Extract against Cotton Sucking Insects: Cotton is one of the most important fibre crops of our country. Studies were made to evaluate the effectiveness of some botanical extracts against cotton sucking insect i.e. aphid, jassid and white fly at four (4) research centers of Cotton Development Board located at Sreepur, Sadarpur, Jagadishpur and Mahigonj. The experiment consisted of eight treatments T₁ = Control (Untreated), T₂ = Mehagony seed extract, T₃ = Khuksha leaves extract, T₄ = Chirata leaves extract, T₅ = Garlic extract, T₆ = Azadiractin (neem extract), T₇ = Bael extract, T₈ = Marigold leaves extract were allocated in the field following randomized complete block design with 3 replications. The incidence of sucking pests was recorded once in a week from 10 randomly plants at each plot. Spraying was done when the pest population crossed the ETL level. Significant differences were found in the relative efficacy of different treatments in

reducing the jassid population and their persistence at different hour after treatment (24, 48 and 72 hours). The leaf and kernel extract of neem was found the best in controlling jassid., after 24, 48 and 72 hours of spraying and increased cotton yield as the highest yield 3.13 t/ha, 3.11 t/ha, 2.87 t/ha and 2.89 t/ha at Sreepur, Rangpur, Dinajpur and Jessore farm respectively compared with other treatment. Plant extracts are biopesticides having less or no hazardous effects on human health and environment. Thus they can be incorporated in IPM programs in cotton cultivation.

Bangladesh Tea Research Institute (BTRI)

Studies and Development of IPM strategies for plant parasitic nematodes in tea: A series of experiments were carried out in different tea estates of six valley circles in greater Sylhet region and BTRI to identify different plant parasitic nematode genera associated with tea seedlings, seasonal abundance and distributional pattern of nematodes in different valley circles, crop loss due to plant parasitic nematodes, nematode incidence related to soil properties, effect of nematicides on soil microorganism, evaluation of some cultural, physical, biopesticides and chemical methods as components of IPM as well as screening of shade trees against nematodes. Soil samples were collected from rhizosphere of tea seedlings of secondary nursery bed using a soil sampling auger at a depth of 0-9". Bearmann Funnel Technique with some modifications was followed to extract nematodes from the soil samples. Plant parasitic nematodes were identified up to genus level based on morphological characters and measurement. A total of ten (10) plant parasitic nematode genera under seven families viz. *Aphelenchus* sp., *Aphelenchoides* sp., *Criconemoides* sp., *Eutylenchus* sp., *Helicotylenchus* sp., *Hoplolaimus* sp., *Meloidogyne* sp., *Pratylenchus* sp., *Rotylenchulus* sp. and *Tylenchus* sp. were identified. Among the identified nematode genera *Aphelenchus*, *Criconemoides*, *Eutylenchus* and *Rotylenchulus* are the first time reported as pests of tea seedlings in Bangladesh. The highest eight (08) nematode genera were found in the tea estates of Balisera valley circle where as the lowest three (03) nematode genera were found in Panchagarh region. The rainfall and nematode prevalence indicate that rainfall positively influenced nematode populations in the soils of tea seedlings in six valley circles. The highest average nematode population (13.29) was found in the tea estates of Balisera valley circle followed by those of Monu-Doloi (12.15) and Lushkerpore (11.25) valley circle. The lowest average nematode population

(5.95) was found in the tea estates of Juri valley circle. On an average 15.34% seedlings mortality was found in different clones in primary bed. The highest nematode population was observed in sandy loam soil followed by sandy clay loam and sandy soil. The population of plant parasitic nematodes was positively correlated with soil pH and organic carbon (%). Result revealed that the physico-chemical properties of soil were slightly changed in nematicides treated plot than control plot. The order of toxicity of the nematicides on soil microflora was: Rugby 10G>Ferterra 0.4G>Furadan 5G>Regent 3GR>Diaton 10G. Results revealed that the clones BT₆, BT₈ and seedling were relatively resistant; BT₂, BT₇ and BT₁₀ were less susceptible; BT₄, BT₅, BT₉ and BT₁₂ were moderately susceptible and BT₁, BT₁₃ and TV₁ were found highly susceptible in primary bed of the nursery. Plant parasitic nematodes were found lower in the plots of heat treatment, steam sterilization and solarization with polythene sheet. The effect of various organic materials, efficacy of some indigenous plant cakes, antagonistic potentials of some commercial microbials and effectiveness of some chemical nematicides against plant parasitic nematodes are in progress. Screening of commonly used shade trees against nematodes in tea is going on.

Bangladesh Agricultural University (BAU)

Improved detection, monitoring and management of two major beetle pests in stored grain through use of a multispecies lure and reduced risk insecticide: Trials with the tested lure (Poultry feed + Yeast) and (Carob + Bran oil) are in progress for detecting insects in raw grain and other products by determining the critical factors that affect multi lure trap catch of two beetles *Callosobruchus chinensis* and *Tribolium castaneum*, in storage. The results indicated that MSTlure- trap is attractive to both the beetles *C. chinensis* and *T. castaneum* with a mean catch efficacy of 54% and 45% respectively within 48 hours after release. Efficacy of bio-pesticide such as Wild mint, Neem, Karanja Mahogany and Spinosad was assessed against red flour beetle and pulse beetle. Comparative effectiveness of botanicals in managing storage pests was determined using oil and leaf powder through direct application and filter paper dip method. Repellency test exhibited superiority of wild mint to other botanicals. Experiment with wild mint as grain protecting is under progress. Spinosad (Tracer 240 SC) at dose of 2.5% was found as the best against target pest showing maximum mortality of 55% at 168 hour exposure time while Neem and Karanja showed the

mortality of 45% and 38% respectively. Mortality of the pests was minimum of 16.67% with 0.5% concentration at an exposure of 24 hour. This findings demonstrate the potentiality of wild mint leaf and other bio-rational materials in managing the stored product insect pulse beetle and red flour beetle.

Small scale on-farm validation trial of a package having (MST Lure + Spinosad) and (MST+ Wild Mint) is on progress at the farmers' storage in Mymensingh region and showed more or less similar results over Sunphos pillets.

Collection and Molecular Characterization of Brinjal and Mango Plant Genetic Resources- Two Important Geographical Indication (GI) Crops of Bangladesh:

The objectives of the present study were to collect and characterize the collected/selected plant genetic resources of mango and brinjal; two important GI crops of Bangladesh using morphological and molecular techniques at the Department of Horticulture, Bangladesh Agricultural University (BAU), Mymensingh. During the reporting period, morphological characterization of 24 collected mango accessions was performed using IPGRI descriptors. Also molecular characterization of 35 collected accessions of mango was carried out using RAPD and SSR markers and results have been presented. Morphological characterization and field performance of 36 collected accessions of brinjal were performed during the reporting period. Along with that molecular characterization of 8 summer and 12 winter-grown germplasm of brinjal was performed using RAPD markers. Molecular characterization of 60 mango accessions selected *in situ* at Chapai Nawabganj and 96 brinjal accessions using RAPD and SSR markers is in progress.

Development of sustainable technologies for improving nutrient and water use efficiency in rice to ensure food security and environmental quality in Bangladesh:

Two field experiments were conducted based on previous findings to determine the performance and efficiency of rice cultivars to different water management systems and nitrogen application. The rice cultivars BRR1 dhan28, BRR1 dhan29, BRR1 dhan60, Binadhan-8 and Binadhan-10, developed by BRR1 and BINA were grown maintaining four irrigation treatments I₁- Continuous saturation, I₂- Alternate flooding and wetting at 8 days after disappearance of 4 cm water, I₃- Alternate flooding and wetting at 10 days after disappearance of 4 cm water,

I₄- BRR1 recommended water management package. The cultivars BRR1 dhan29, BRR1 dhan59, Binadhan-8 and Binadhan-10 were grown in another experiment maintaining six nitrogen source N₁- Control, N₂- 140 kg N ha⁻¹ from prilled Urea (PU), N₃- 83 kg N ha⁻¹ from Urea Super Granule (USG), N₄- 105 kg N ha⁻¹ from PU + 3 t ha⁻¹ Poultry manure, N₅- 112 kg N ha⁻¹ from PU + 5 t ha⁻¹ Cowdung, N₆- 77 kg N ha⁻¹ from PU + 4 t ha⁻¹ vermi compost. The treatments were arranged in split-plot design for water management experiment and RCBD for nitrogen management. Cultivars and water management systems showed significant effect on the growth, physiological, yield and yield contributing characters of different rice cultivars. The highest grain yield (5.985 t ha⁻¹) was obtained from Binadhan-10. In respect of water management systems, alternate flooding and wetting at 8 days after disappearance of 4 cm water (I₂) produced maximum grain yield (6.139 t ha⁻¹). It was also found that the crop grown continuous saturation (I₁) treatments respectively did not increase the yield, rather caused the wastage of irrigation water. The water use efficiency (WUE) was the highest (0.240 t ha⁻¹cm⁻¹) in treatment I₃, obviously due to minimum water use but highest yield was observed in I₂ because of optimum use of water and non stress condition. In respect of nitrogen management, Binadhan-10 produced maximum grain yield (5.431 t ha⁻¹). 105 kg N ha⁻¹ from PU + 3 t ha⁻¹ Poultry manure produced maximum grain yield (5.827 t ha⁻¹).

Algae culture as environment friendly feed supplements for poultry:

Spirulina is microalgae contains higher amount of nutrients including protein, carotenoids and micronutrients and grown in organic or inorganic media. So, considering the facts a number of 144 broiler chicks were reared for a period of 7 days and afterwards birds were divided into six dietary groups (24 birds in each group and 8 birds per cage). Vitamin mineral premix of the feed was replaced by the media dry matter at 0, 25, 50, 75 and 100% considering group 1, 2, 3, 4 and 5. Further group 6 was considered as negative control where both vitamin mineral premix and *Spirulina* was absent. The feeding was continued subsequent 21 days (28 day old). Final body weight was 999, 985, 977, 953, 933 and 859g/bird in group 1, 2, 3, 4, 5 and 6 where significantly (0<0.5) higher weight observed in control as well as group 2, 3 and 4, but was lower in group 5 as well as negative control (group 6). But feed intake observed more or less similar in all the groups (1500g; p<0.5). Feed conversion ratio (kg FI/kg LWG) observed significantly different like 1.79, 1.80, 1.84, 1.88, 2.04 and 2.08 in group 1, 2, 3, 4, 5 and 6

respectively ($p < 0.5$), where higher in negative control group (6) and 100% replacement group (5). So, vitamin mineral premix would be possible to replace by the *Spirulina media* up to 75%.

Resistant breeding for salinity stress tolerance in Rice:

A total of twenty two (22) rice genotypes including advanced lines and modern varieties were used to carry out this research for screening salinity tolerant genotypes by morphological and molecular analysis. Salinity screening was performed at seedling and reproductive stages using modified hydroponic method and sustained water bath following IRRI standard protocol respectively. For the phenotypic study of 22 rice genotypes, saline water having EC 6dSm^{-1} was used at seedling stage. At reproductive stage, saline water having EC 0dSm^{-1} , 8dSm^{-1} , 10dSm^{-1} and 12dSm^{-1} were used. Based on SES standard scoring, Binadhan 8, RC 221, RC 225, RC 191, Binadhan10, FL-478 genotypes were found to be tolerant at seedling stage. After different phenotypic study at reproductive stage, variety Binadhan8, Binadhan10, Pajam, BRRI dhan39, RC 225, FL-478 were found to be tolerant while RC 192, Cherangi, Binadhan7 were found to be susceptible. Rest of the genotypes RC 217, RC 225, RC 227, RC 193, BRRI dhan29, RC 249 and RC 222 were found to be moderately tolerant. All the tolerant genotypes performed best at nonsaline condition and lowest performance was observed at 12dSm^{-1} salinity stress. Rice genotypes showed wide variations in salinity tolerance phenotypically at both stages. For molecular study of rice germplasms, DNA was extracted from young leaf samples using IRRI standard method. In this study three (3) selected SSR markers viz. RM32, RM80 and RM1287 were used to screen the genotypes for salt tolerance. Banding pattern of rice lines against three SSR markers identified RC 191, RC 192, RC 225, RC 217, Binadhan8 and Binadhan10 as salt tolerant genotypes. From the SSR analysis, it was found that an average number of 8 alleles per locus were detected with PIC values ranged from 0.7067 (RM32) to 0.8309 (RM1287). The highest gene diversity (0.8471) was observed in loci RM1287 and the lowest gene diversity (0.7479) was observed in loci RM32 with a mean diversity of 0.8085. Four SSR markers viz. AP3206f, RM1287, RM7075, and RM10793 were used to screen the germplasm for salt tolerance. SSR analysis revealed that the number of allele per locus ranged from 3 to 5 with an average of 4.25 alleles per locus. Polymorphism Information Content (PIC) values ranged from 0.4762 (RM7075) to 0.7524 (AP3206f) with an average of 0.61 per locus.

The highest genetic diversity (0.7810) was observed in loci AP3206f and the lowest genetic diversity (0.5620) was observed in loci RM7075 with a mean diversity of 0.6663. AP3206f was the best marker for identification of salt tolerance genotypes as revealed by PIC values. The Un weighted Pair Group Method with Arithmetic mean (UPGMA) genogram revealed 2 major groups with 12 clusters. These screening results could be used for further selection and development of improved salt tolerant varieties, as salinity stress is a great challenge for plant breeders.

Constraints to the Development of Small Scale Agribusiness Enterprises in Bangladesh:

Most of the people in Bangladesh have little knowledge on agribusiness activities. Due to various reasons, cultivable land in Bangladesh is decreasing at an alarming rate. In this situation, agribusiness enterprises can generate more income and employment by adding more value to agricultural products using less land. Both primary and secondary data were used for the study. Ten villages under Laxmipur-kholabaria Union of Natore Sadar Upazilla in Natore district and ten Unions of Barlekha Upazilla in Moulabazar district were selected as study area for medicinal plant and aromatic plant respectively. Already some basic data were collected through two periodic 'Focus Group Discussion' (FGD) organized with the participation of the medicinal and agar plant (MAP) entrepreneurs/actors and representatives of local Upazila Agriculture Offices and interviewed to several lead MAP entrepreneurs/actors in the study areas by using a checklist and a schedule as well as based on information recorded and field observation. For getting secondary information several research papers, literatures and documents were collected from different agriculture and agribusiness line agencies and from website. Thereafter, the collected data and information were arranged systematically and purposely for achieving the objectives of the study. Based on the collected basic information, methodology and questionnaire for the study have already been developed and collection of primary data is in initial stage. Some major problems and constraints were identified through the FGDs and face to face interview with the MAPs entrepreneurs and actors; For the medicinal plant enterprises, the major problems are: high price and low quality of inputs, high irrigation cost, lacking of scientific and appropriate knowledge and experience of the MAPs entrepreneurs and actors; absence of local assembling and processing centre and non-availability of government support. For the agar-

atar enterprises, the problems are: absent of official recognition and priority of this sector; scarcity of standard/quality testing tools and machineries of government; high duty imposed by the imported countries; complexity of 'Transit Permit' (TP) and CITES Certificate. The participants of the FGD strongly recommended taking necessary steps for the solution of the problems through government and non-government organizations' initiatives. For the medicinal plant enterprises, some major steps are: quality inputs supply in lower price; available electric supply; provide necessary training to the entrepreneurs/actors on scientific activities regarding MPs enterprises and establish assembling, processing and ICT centre. For the aromatic plant enterprises some major steps are: give priority agar-atar industry in publishable 'National Industry Policy – 2015'; take actions for modernization of the Barlekha Agar-Atar Production Cluster and Processing Plant; make easy and relax of TP and CITES delivery; develop fast growing hybrid gene of agar plant; reduce import duties and make easy access of the agar-atar products to different export countries and establish a standard testing lab in the Barlekha agar-atar cluster.

Molecular characterization of a *B. anthracis* isolated from the field cases of Bangladesh and selection of vaccine candidates: The research work was aimed at isolation and identification of *Bacillus anthracis* from soils, meat, blood and swab samples. A total of 184 soil, 1 blood, 3 meat and 1 swab samples were collected from different areas of Bangladesh during anthrax outbreaks during July 2015 to June 2016. Besides, molecular characterization of the *B. anthracis* vaccine strain (stern F34) was performed. To know causes of repeated outbreak of anthrax in Kushtia, Sirajganj and Pabna districts, an epidemiological investigation was performed. The DNA from the soil samples were extracted, and were subjected for molecular detection of *B. anthracis* targeting Cap (pX02 plasmid), Sap (*B. anthracis* specific) and Pag (pX01 plasmid) genes. The bacteria associated with blood, meat and swab samples were isolated and primarily identified as *B. anthracis* through a series of conventional bacteriological and biochemical characteristics, followed by PCR confirmation targeting Cap, Sap and Pag genes. So far 129 soil samples have been tested for the presence of spores of *B. anthracis*. Among 129 soil samples, the viable *B. anthracis* spores could be extracted from 21 (16.3%) samples. All the blood, meat and swab samples were confirmed to be associated of *B. anthracis*. All the 21 soil samples were confirmed for the presence of Sap

gene of *B. anthracis* showing 639-bp target size in gel electrophoresis. Both pX01 and pX02 plasmids were harbored in 3 isolates. On the other hand, both pX01 (target size 596-bp) and pX02 (target size 846-bp) were present in 12 isolates. The vaccine strain was confirmed to be present Sap and Pag genes. The qualitative study revealed that lack of vaccination and unawareness were the main causes of repeated outbreak of anthrax in Bangladesh. In conclusion, pX01 and pX02 plasmids have been identified in Bangladesh isolate of *B. anthracis*. Effective vaccination program and awareness among people can be implemented for the effective control of anthrax in Bangladesh.

Study of reproductive endocrinology of mud eel *Monopterus albus* for artificial propagation: The research project is aimed at to obtain basic information on reproductive biology of *cuchia*, its domestication, captive maturation and fry production trial through induced spawning. Information on reproductive biology, food, feeding, behavior, etc of *cuchia* has been revealed through research on this species during the last four years of this project. This year, the main aim was to trial on fry production. Both environmental manipulation and uses of Exo-hormones trial had been carried out for the fry production of *cuchia*. This study could produce more than 4500 *cuchia* fry through manipulating environment. From these fry, feeding trial is being carried out with 2400 fry by using different feeds. Again, induced breeding trial by using Exo-hormone (PG and SGRHa) was unsuccessful. Year round changes in some haematological parameters (RBC, WBC, Haemoglobin, Blood glucose, Mean corpuscular haemoglobin, mean corpuscular volume) were also observed and significant variations in haematological parameters were found in different seasons. First time reference values for major haematological parameters of *cuchia* have been established through this study. Histological observation on male gonad conducted within this study indicates that like female, male *cuchia* occupies one breeding season, which starts from the month of March and ends at the month of June and the peak breeding season is Mid April to Mid May. September to December is the dry period and testis starts to develop again from the month of January.

Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU)

Development of short duration high yielding aromatic rice variety suitable for three growing

seasons of Bangladesh: This research was done to determine yield performance of new aromatic rice over the three growing seasons of the year. The new rice (BU-9958-40-1) was developed through hybridization between Indian Basmati and IR58025B. The advanced line possesses characteristics of earliness, aroma and high zinc and iron content. This line was evaluated against three varieties during three consecutive seasons of 2015-16 at seven locations of the country. The check varieties for the experiment were BUDhan1, BRRI dhan 50 and BRRI dhan65 for Aman, Boro and Aus season, respectively. The experimental locations were spread at BSMRAU, Kapasia, Rangpur, Chuadanga, Ishurdi, Faridpur and Chittagong. Results of Aus and Aman seasons are available while Boro crop is recently harvested. Results of Aus seasons revealed that the new rice performed better at Chuadanga, Ishurdi and Faridpur with an average yield of 3.95 t ha⁻¹ in comparison to yield (3.54 t ha⁻¹) of BRRI dhan65 as check variety. Similarly, in Aman season, the new rice yielded 4.31 t ha⁻¹ against the yield of check variety (4.27 t ha⁻¹). Considering better yield, earliness, aroma along with high zinc and iron content, this advanced line of rice is expected to release as a new rice variety suitable for growing three seasons of the country.

Hajee Mahammad Danesh Science and Technology University (HDSTU)

Seed production of endangered *Cirrihinus reba*: potential as a new aquaculture species and for its revival: The reba carp, *Cirrihinus reba* locally known as Khorkia or Bhagna/Tatkini belongs to the cyprinidae family. Recently the fish is considered as “Near Threatened” categories by IUCN- Bangladesh. By considering its threatened situation and aquaculture potentialities, initiatives were taken to domesticate the wild stock in captivity, to investigate the food habit and reproductive biology, and induced breeding through hypophysation. Live *C. reba* were collected from three rivers of Dinajpur district and reared in the earthen ponds under common broodstocks rearing techniques. Along with the length and weight data, the water quality parameters such as pH, DO, temperature etc. were recorded during domestication of the fish. The food habit was determined by the assessment of gut fullness, gut content and the value of relative length of gut (RLG). Fecundity, and gonadosomatic index (GSI) were determined to assess the reproductive potential of the species. Subsequently three different dosages of carp pituitary gland extract were used for induced

breeding of *C. reba*. The result of domestication of *C. reba* in captive condition showed moderate growth and survival rate. The comparison of length-weight relationship between domesticated and wild stocks of *C. reba* showed allometric growth pattern. It is found that, *C. reba* is an omnivore fish, prefers to feed on debris and plants. The fecundity ranged from 21,44 to 212,570 eggs, where the fecundity increase with the increase of total length, gonad weight and body weight of the fish. The gonado-somatic index (GSI) ranged from 2.00 to 12.20 in female and showed peak in June with the highest ova diameter (2.90mm). The fish ovulated with the hormonal injection of pituitary gland extracts. The ovulation, fertilization and hatching rate were found 60%, 70% and 50% in the initial study. The result of this study showed the potential of seeds production of this fish through hypophysation. The seed production could be the effective means of revival from the being extinction by restoration. The more induced breeding trials and, larval rearing and culture techniques will be developed under this project in the coming FY 2016-2017.

Sylhet Agricultural University (SylAU)

Validation and Dissemination of Newly Developed Rapeseed-Mustard Varieties in the High Land and Haor Ecosystems in Sylhet Region: There were four training programmes conducted at four upazila viz. Sadar-Habigonj, South Sunamgonj-Sunamgonj, South Surma-Sylhet and Jaintapur-Sylhet districts during November 2015. Four field days were also conducted at the same location under pre-sowing training during field maturity of the crops in the month of January and February 2016. Seeds of HYV of BARI sarisha-14 were distributed among the farmers of Sadar-Habigonj, South Sunamgonj-Sunamgonj and South Surma-Sylhet districts. Seeds of HYV of BARI sarisha-11 were distributed among the farmers of Jaintapur, Sylhet district during training. Average seed yield was 981 kg ha⁻¹ at South Surma, 963.5 kg ha⁻¹ at South Sunamgonj, 1100.8 kg ha⁻¹ at Habigonj Sadar and 1954.4 kg ha⁻¹ at Jaintapur. It was found that maximum gross margin Tk 13308/- ha⁻¹ was obtained at Jaintapur followed by Rajoiri, Habigonj having gross margin Tk 12035/- ha⁻¹. Maximum return Tk⁻¹ investment was 1.28 at Rajoiri followed by 1.24 at Jaintapur. At South Sunamgonj return was found non-profitable and it was Tk 0.95 Tk⁻¹ investment.

Yield gap minimization of boro rice in the haor areas through agronomic management with special

reference to fertilization: The project was implemented in the representative of the deeply flooded low lying area of *haor* (Dekar *haor*) at the village Bahadurpur under union Lakshanshri of Sadar upazila of Sunamganj district. The project was aimed to minimize the yield gap of boro rice in the *haor* area under Sunamganj district and piloting the developed technology package for further dissemination. Three experiments were conducted in the first year programme to fulfill the objectives. The first experiment was the yield gap minimization of two varieties boro rice with the proper use of fertilizers to see the varietal performance and fertilizer effect on growth and yield of boro rice. Two varieties (BRRIdhan 29 and BRRIdhan 58) and three fertilizer treatments (Farmers practice, Fertilization based on BARC recommendation guide and Soil test based fertilization) were included in the experiment. BRRIdhan58 showed the better performance in respect to growth and yield with fertilizer dose of BARC recommendation guide. The 2nd experiment was entitled 'effect of fertilizer and irrigation methods on the yield gap minimization of boro rice' to see the effect of fertilizer and irrigation methods on growth and yield of boro rice. Two fertilizers doses (Farmers practice and Fertilization based on BARC recommendation guide) and three irrigation treatments (Farmers practice, Dry and Wet method of irrigation, and Wet irrigation method) were included in the experiment. The grain yield obtained 7.70 t ha⁻¹ in the farmers' plots and 8.54 t ha⁻¹ due to fertilizer balance application. The highest yield of 8.36 t ha⁻¹ was obtained due to wet irrigation system. The title of 3rd experiment was the 'effect of fertilizer and agronomic practices on the yield gap minimization of boro rice'. The experiment was conducted in five farmers' fields with two fertilizers doses (Farmers practice and Fertilization based on BARC recommendation guide) and three fertilizer treatments ((Farmers practice, Proper seedling age and spacing; and Proper seedling age and spacing + Integrated Pest Management). BRRIdhan58 gave the higher yield with application of balance fertilizers. The 4th and 5th experiments were conducted in five farmers' fields each with seven treatments only difference was in variety i.e. BRRIdhan29 and BRRIdhan58. The treatments were - T₁ = Farmers' practice fertilizer; T₂ = BARC Recommendation Dose; T₃ = T₂+ Wet Irrigation; T₄ = T₂ + Wet and Dry Irrigation; T₅= T₂+Proper Seedling Age + Spacing; T₆= T₂+ PSA +Spacing + IPM; T₇ = IPNS + PSA + Spacing + IPM. Results indicated that all the treatments showed superior performance in

growth, yield and yield contributing characters over farmers practice.

Development of artificial breeding techniques of *Sperata aor*:

A number of brood fish were collected and reared in the research ponds both on station (Research ponds in the Sylhet Agricultural University campus) and on farm (American fish farm Ltd. at Zakigonj) for nine months periods. Their growth performances were measured on month basis. To examine the monthly changes in the gonads for estimating spawning season, the GSI was calculated by: $GSI = (\text{Weight of gonads}/\text{weight of fish}) \times 100$. The average length and weight of the *Sperata aor* fry became 27 cm and 148 gm, respectively on station in April. While on the farm it became 39 cm and 700 g, respectively. On the other hand, average length and weight of the brood became 34 cm and 500 g, respectively on station. While on the farm it was 45 cm and 1000 gm, respectively. The brood fishes reared in on station ponds did not perform natural breeding yet. But on the other hand, natural breeding of *S.aor* was observed in on farm in captivity. The GSI of female was found to be decreasing from October to February and lowest was recorded on December. It was found to be increasing from February to May. On the other hand, the lowest GSI (Gonado-somatic Index) value of male was found in November and after that it was gradually increasing and the highest was observed in May.

Patuakhali Science and Technology University

Increasing fertilizer and irrigation water use efficiency for crop production in southern coastal saline soils of Bangladesh: Soil and water salinity is the number one constraint for crop production in coastal region of Bangladesh. Deep tidal water height is the second most important constraint for nitrogen management in this area. Appropriate technology is needed for management of saline soils which can ensure limited use of irrigation water. The project is therefore undertaken to coastal region which will successfully reduce the evaporation loss of water from soil. Five experiments were undertaken during July 2015 to June 2016. Three different colour polythene mulch (Blue, black and white) and rice straw mulch were compared with non mulch control treatment. White and blue polythene mulch treatment had 1-2 °C higher soil temperature compare to non mulch condition. Sulphur content was generally higher in coastal region which decreases p^H value below 5, polythene mulch helps to decrease this excess available

S content. The maize and sunflower yield was at least double in polythene mulch treatment than without polythene mulch treatment. White polythene mulch had the highest grain and straw yield, followed by blue polythene. The soil EC value was very high and pH was very low in 0-1 cm soil depth. With the increases of soil depth EC value drastically decreased and pH value increased. Urea super granule was found best in relation to higher grain and straw yield of deep tidal water flooded T. Aman rice. Polythene mulch and urea super granule technology is recommended for much popularization in the coastal saline regions of Bangladesh.

C. Monitoring of Programmes/Activities

Nine teams were formed with the scientists of BARC for field monitoring of the research/technology transfer programs carried out during the year. The teams were assigned to visit and monitor the BARC funded core research activities in different location of Bangladesh which were implemented by different NARS and associate institutes.

Team composition for Field Monitoring of Research activities under Research Grant Fund of BARC (2015-16)

Team No.	Locations	Institutes Involved	Project-No.	Team Composition
1.	Dhaka Savar Norshingdi	BARI (Narshingdi) BJRI (Dhaka) SRDI (Dhaka) IEDCR (Mohakhali) BAU (Savar, Dhaka)	3, 18, 19, 30	Dr. Md. Aziz Zilani Chowdhury, MD (Crops)- Team Leader Dr. M Baktear Hossain, PSO (Soil)-Member Mr. Jasim Uddin Chowdhury, DD (Budget)- Member
2.	Gazipur, Dhaka	BRRI (Gazipur) BARI (Gazipur) CDB (Sreepur) BSMRAU (Kapasias)	3, 6, 7, 16, 24, 32, 33	Dr. Sultan Ahmed, MD (NRM)-Team Leader Dr. Fauzia Yasmin, PSO (TTMU)-Member Dr. Md. Mosharraf Uddin Molla, PSO (AERS)- Member
3.	Mymensingh Jamalpur Sherpur Netrokona Bhaluka	BARI (Jam, Sher, Net.) BAU ((Mymensingh) BINA (Mymensingh) HDSTU (BAU, Mymen)	4, 6, 8, 12, 13, 16, 17, 23, 27, 30, 31, 35, 36, 38	Dr. Shah Md. Ziqrul Haque Chowdhury, MD (Livestock) - Team Leader Mr. Ajit Kumar Chakrabarty, Director (Finance)- Member Mr. Md. Mustafizur Rahman, PTO- Member
4.	Rajshahi, Natore Naogaon, Chapai. Bogra, Pabna Sirajgonj Joypurhat Saidpur	BARI (Raj. Joy. Bog. Pabna,Nato.), BRRI (Raj. Chapi. Kush), BINA (Raj.), BSMRAU (Ishurdi, Pab.), BAU (Siraj, Bogra. Naoga.) BFRI (Saidpur)	3, 6, 12, 15, 16, 24, 25, 31, 39	Dr. A.S.M Anwarul Huq, MD (AERS)- Team Leader Mr. Rafiq Mustofa Kamal, Director (AIC)- Member Dr. Md. Abdus Salam, PSO (Crops)-Member
5.	Rangpur Dinajpur Kurigram Nilphamari Lalmomirhat	BARI (Rangpur. Nilphamari). HDSTU (Dinajpur) CDB (Dinajpur) BRRI (Kurigram) BSMRAU (Rangpur)	3, 6, 11, 16, 25, 31, 36, 39,	Mr. Md. Abeed Hossain Chowdhury, Director (Computer)-Team Leader Dr. Rina Rani Saha, PSO (Crops)- Member Dr. Md. Saifullah, PSO (Forest) – Member
6.	Greater Sylhet Region Sunamgonj	BTRI (Srim. Moulabi) SAU (Tilagor, Syl. Suna.) BARI (Netr. Moulabi) BRRI (Habigonj) BAU (Moulabi bazar)	2, 10, 16, 20, 26, 30, 31	Dr. Mohammed Shahjahan, CSO (Forestry)- Team Leader Dr. Monirul Islam, Director (Nutrition)-Member Mr. Md. Abdul Mottakin, DD (Est.)- Member

7.	Chuadanga Jessore Jhenaidah Kushtia Magura Satkhira	BARI (Jessore. Jheni. Kustia) CDB (Jogodispur, Jess) BRRI (Satkhira) BSMRAU (Chuadanga) BAU (Jessore)	6, 7, 14, 18, 30, 31, 39	Dr. Kabir Ikramul Haque, MD (Fisheries)- Team Leader Dr. S. M. Bokhtiar, PSO (Soil)-Member Dr. S. M. Khorshed Alam, PSO (Crops) – Member
8.	Barisal Bhola Jalokathi Patuakhali	BARI (Barisal, Bhola, BRRI) BSMRAU (Barisal, PSTU (Kalapara, Patuak)	5, 7, 14, 16, 21, 31, 37	Dr. Md. Abdus Satter, CSO (Soil)- Team Leader Dr. Nazmun Nahar Karim, PSO (Agril. Eng.)-Member Dr. Kabir Uddin Ahamed, PSO (P&E) - Member
9.	Comilla Chittagong Hathazari Rangamati Cox's Bazar Bandarban Khagrachari	BARI (Comilla, Chitta.Hatha. Khagra. BSMRAU SRDI (Meghla, Bandarban) BFRI (Cox's Bazar) BAU (Cox's Bazar)	6, 7, 9, 14, 16, 22, 28, 30, 39	Mr. Md. Aminuzzaman, Director (M&T) – Team Leader Dr. Md. Abdul Awal, CSO (P&E)-Member

Field Monitoring Report of (2015-2016) Research Grant” of BARC

BARC visited BARI, Gazipur on July 2015. Research projects was monitored by the team.

Development of a mechanical vegetable washing machine

Monitoring Report of Team-1

The team 1 consists of Dr. Md. Aziz Zilani Choudhury, Member Director (Crops), BARC (Team leader), Dr. Md. Baktear Hossain, PSO (Soils), BARC and Md. Jashim Uddin Choudhury, Deputy Director (Budget),

PI: Dr. Md. Nurul Amin, Senior Scientific Officer, Farm Machinery and Postharvest Process Engineering Division, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur-1701

Major Activities

	Planned Activities	Implementation Status
1	Modification of the prototype	Modification is completed
2	Laboratory testing and data collection	Performance tests of the machine with leafy, fruit and root crops were done in the laboratory. Test results of the machine were satisfactory due to higher capacity, cleaning efficiency and low operating cost
3	Fabrication of final prototype	Fabrication of final prototype will be started after receiving fund
4	Testing and demonstration in project sites	Demonstration of the machine was done at Varaimari, Ishurdi, Pabna on 4 April 2016
5	Report submission	Annual report of the project will be submitted in June 2016

Budgetary Information:

- i) Total Approved Budget, 2015-16 Tk: 400,000.00
- ii) Fund released (July 2015 to March 2016) Tk. 300,000.00
- iii) Fund spent ((July 2015 to March 2016): Tk: 300,000.00

Constraints	Suggestions
Delay in fund releasing hampered to conduct project activity in due time	Quarterly fund should be released in timely

Constraints & Suggestions:

Any other information: Team leader of the project arranged a demonstration before the monitoring team.

The machine works nicely and washed lalshak, Carrot, Brinjal properly.

Detailed description of the major activities and their status of the project in 2015-16

Activity 1: Modification of the prototype

A mechanical vegetable washing machine was fabricated with locally available materials as per design of the project at Farm Machinery and Postharvest Process Engineering Division, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur in 2015. Overall dimension of the machine is 3759 mm × 1473 mm × 1676 mm. The isometric view, front, side and top views are presented in Fig. 1 and 2. The vegetable machine is made into two units on the basis of vegetables type. One is for leafy and fruit vegetables and another is for root vegetables. Leafy, fruit vegetable unit and root crops washing unit are shown in Fig.3. Main parts of the leafy and fruit vegetables unit are such as trapezoidal type water tank; net type conveyer; power transmission system; water spray system; and trays. Main parts of the root vegetables unit are such as chassis; brush type roller; power transmission system and water spray system. The conveyer net and brush roller of both the units are run by means of chain sprocket by same electric motor of 1.1 kW. Water spray through perforation pipe for both units is pumped by the same centrifugal pump of 1.1 kW. Revolutions per minutes of the conveyer net and brush roller are 20 rpm and 92 rpm respectively. After preliminary performance test, some modifications were needed for better performance of the machine. The following modifications of the machine were done.

1. RPM of brush roller reduced from 100 to 92 to increase washing quality of root vegetables without injury.
2. Increased force of water flow and canopy of water flow by decreasing the diameter of perforation of pipe.
3. Connected the flow meter of ranged from 0 to 16 m³/h and pressure gauge of ranged from 0 to 4 kg/cm² to measure the water quantity and water flow pressure.
4. Connected the strainer in water suction pipe for sucking the dust, inert materials and vegetable parts to recycling the water.
5. A platform was made for easy handling the root crops and operator so that operator can easy operate the machine.

6. A kilowatt hour meter was connected with the panel board for measure the power consumption



Leafy, fruit vegetable unit and root crops washing unit

Activity 2: Laboratory testing and data collection

Fresh red amaranth, Indian Spanish, radish and carrot were harvested from experiment field of Farm Machinery and Postharvest Process Engineering Division, Jodebpur, Gazipur to conduct the performance test of the machine as need. Besides this, radish were collected from farmers' field at Marta, Joydebpur, Gazipur and fresh red amaranth, Indian Spanish, radish and carrot from Chowrasta wholesale market, Vogra, Gazipur to conduct the experiment. Brinjal, country bean, red amaranth and Indian Spanish were washed with fresh water by using leafy and fruit conveyer net unit to evaluate the capacity, efficiency, electric energy use, water use, pressure and injury percentage etc (Table 1). The capacities of the machine in respect of brinjal, bean, red amaranth and Indian Spanish were found to be 0.91-1.5 t/h for red amaranth, 1.5 t/h for brinjal, 0.80-1.0 for country bean, 0.8-2.0 t/h for Indian Spanish. Water use was 8.24 l/kg for red amaranth, 5.25 l/h for brinjal, 5.5 l/h for country bean, and 6.6 l/h for Indian Spanish. Electric energy consumption for washing per kg were 4 kWh/t for red amaranth, 1 kWh/t for brinjal, 2 kWh/t for country bean, 1.3 kWh/t for Indian Spanish. Water pressures of all the treatments were found to be 1kg/cm² except red amaranth (1.2 kg/cm²). No injury percentage of brinjal, red amaranth and Indian Spanish was observed but 0.02 percentage of injury observed in country bean due to beans insert into conveyer net hole. Dust and inert material removed from vegetable surface successfully. In case of carrot, capacity of the machine was 0.80 t/h. Water use and electric power consumption was found to be 6.4 l/kg and 11 kWh/t respectively. It observed that from figures 4, 5, and 6, washing quality of

different vegetables were better colour appearance compare with the traditional practice.

Performance test of machine for carrot

The root vegetable unit was tested with carrot harvested from FMPE experiment field on 24 February, 2016 (Table 2 and Fig.7). It was observed that washed carrot is better appearance than that of unwashed carrot (Fig. 8). It was also observed that washed carrot by machine was better than that of hand washed carrot. From table 2, the capacity of the machine for carrot was 693 kg/h at 2 min, 460 kg/h at 3min and 345 kg/h at 4 min. The lowest injury of carrots was found to be 1% in three minute treatment followed by 2 and 4 minutes treatments. Two labours are required for operating the machine.

Treatment: T₁= Control (harvested fresh carrot)= 23.9 kg, T₂= Hand washed fresh carrot= 22 kg

Conclusion

A mechanical vegetable washing was designed and fabricated with locally available MS materials at FMPE Division, BARI, Gazipur in 2015. Overall dimension of the machine is 3759 mm × 1473 mm× 1676 mm. The performance test of the machine with selected vegetable was done successfully. Some important modifications were done and improved it capacity. The capacities of the machine were ranged from 1 to 2 tonne per hour for leafy and fruit vegetables and about 0.5 tons per hour for root crops. The power require for operating machine is about 3 kW. The price of the machine is about 2 lac taka. The washing efficiency is

about 98% and washing cost is low due to high capacity machine. Demonstration of the machine has to be manged in the farmers' field. The machine needs to be modified according to farmers, traders and scientists' opinions. Finally, final proto type of mechanical vegetables washing machine will be fabricated.

Monitoring Report of Team-3

The team members were Dr. Shah Md. Ziqrul Haq Chowdhury, Member Director (Livestock), BARC (Team leader), Mr. Ajit Kumar Chakrabarty, Director (Finance), BARC and Dr. Fauzia Yasmin, PSO (TTMU), BARC visited BARI, Gazipur; BAU, Mymensingh; BINA, Mymensingh and Hajee Mohammad Danesh Science and Technology University (HDSTU), Dinajpur during 23-25 March, 2016. A Total of nine research projects were monitored by the team.

Improved detection, monitoring and management of two major beetle pests in stored grain through use of a multispecies lure and reduced risk insecticide

PI: Dr. Mahbuba Jahan, Professor, Department of Entomology, Bangladesh Agricultural University Mymensingh.

Major Activities*:

Implementation status of the planned activities for the monitoring period:

	Planned Activities (July 15- June '16)	Implementation Status
1.	Development of multi lure technology for detection and monitoring of insect	Trials with the tested lure (Poultry feed + yeast) and (Carob + Bran oil) are in progress for detecting insects in raw grain and other products by determining the critical factors that affect multi lure trap catch. The results indicated that MST lure-trap is attractive to <i>C. Chinensis</i> and <i>T. castaneum</i> , with a mean catch efficacy of 54% and 45% within 48 hours after release respectively.
2.	Determining the bio-rational based pests management against pulse beetle and red flour beetle	Efficacy of bio pesticide such as wild mint, Neem, Karanja Mahogany and Spinosad was assessed against red flour beetle and pulse beetle. Comparative effectiveness of botanicals in managing storage pests was determined. Oil, leaf powder and filter paper dip method was used. Repellency test exhibits that wild mint was superior than other botanicals. Experiment with wild mint as grain protecting material is going on. Spinosad (Tracer 240 SC) was found as the best against target pest showing maximum mortality of 55% at 2.5% dose at 168 h exposure time and minimum 16.66% with 0.5% concentration at exposure of 24

		h. Neem showed 45% mortality at 168 h exposure time with 2.5% concentration and 16.67% with 0.5% dose at 24 h exposure time followed by Karanja with 38 % mortality. Two MS Theses are on progress and expected to be submitted by June 2016.
3.	Validation of the optimal IPM strategies for storage	Small scale on-farm validation trial is on progress at the farmers' storage in Mymensingh region same as previous year. A package with (MST Lure + Spinosad) and (MST + Wild Mint) showed more or less similar results over Sunphos pillets.

Budgetary Information: i) Total Approved Budget, 2015-16 Tk: 400000.00
ii) Fund released (to date) Tk: 200000.00
iii) Fund spent (to date) Tk: 193971.36

Constraints & Suggestions:

Constraints	Suggestions
1. Crop damage penalty is unpredictable	1. Compensation is suggested, as said by P.I.
2. Escalation of Labour price and Renting storage	2. Compensation is suggested, as said by P.I.

Any other Information: Based on the discussion with P.I. and other workers, the laboratory activities and other works are progressing well.

Collection and Molecular Characterization of Brinjal and Mango Plant Genetic Resources- Two Important Geographical Indication (GI) Crops of Bangladesh

#	Planned Activities	Implementation Status
1.	Collection of germplasm of mango and brinjal from different parts of Bangladesh	At Chapai Nawabganj and study on morphological traits is going on. mango germplasm at Horticulture Farm, BAU are going on. different parts of Bangladesh and study at the Horticulture Farm, BAU, Mymensingh.

2.	Molecular characterization of the collected germplasm of mango and brinjal	Work is going on at BAU using RAPD and SSR markers. Molecular characterization of mango from Chapai Nawabganj are on using RAPD and SSR markers. Molecular characterization of brinjal using RAPD markers is going on. Molecular characterization of mango and brinjal collected from different parts of Bangladesh is going on using SSR markers.
3.	Establishment of the relationship between the PGRs and molecular markers	Work is going on (of the field and molecular studies)
4.	Preparation of reports and documents	Is in progress

Budgetary Information: i) Total Approved Budget, 2015-16: Tk: 4,00,000.00
ii) Fund released up to December, 2015 Tk: 2,00,000.00
iii) Fund spent (to date): Tk: 1,63,674.00

Constraints & Suggestions:

Constraints	Suggestions
Timely release of fund	BARC should take care about timely release of fund.
Availability of quality molecular markers and reagents on time	P.I. should be active and cautious throughout the procurement process about getting quality chemicals and reagents.
Lack of manpower at technician level for doing molecular works	All staffs and students involved in the project should be trained, guided and supervised by the P.I.



Resistant breeding for salinity stress tolerance in Rice

PI: Professor Dr. Lutful Hassan, Department of Genetics and Plant Breeding, Bangladesh Agricultural University, Mymensingh.

Major Activities*:

	Planned Activities	Implementation Status
1.	Collection of genotypes	Thirty rice genotypes of which six were collected from the head office of Bangladesh Rice Research Institute, Joydebpur, Gazipur and remaining twenty four genotypes were collected from southern part of Bangladesh
2.	Phenotypic study of salinity tolerance at seedling stage	Phenotypic study is conducting in hydroponic Experiment.
3.	On farm variety trial with salt tolerance advanced lines to look into the survival rate and growth performance of the seedlings	The seedlings will be treated with saline water with 0 dsm ⁻¹ (control), 6 dsm ⁻¹ , 10 dsm ⁻¹ and maintained up to 14 days in saline condition and the data collection is in progress.
4.	Selection of advanced rice lines for salt tolerance through SSR markers	Six SSR markers will be used to evaluate 30 rice genotypes. The markers are- 1. AP3206f 2. RM336 3. RM3412b 4. RM10694 5. RM493 6. RM10793

* Detailed description of the major activities and their status to be provided in separate sheet (Appendices 1, 2)

Budgetary Information: i) Total Approved Budget, 2015-16 Tk: 4,00,000/-
 ii) Fund released (to date) Tk: 2,00,000/-
 iii) Fund spent (to date) Tk: 2,00,000/-

Appendix 1: Name of the Varieties of the experiment

1. Chapshali	11. Boilam	21. Honumanjata
2. Thikeirum	12. Jamaibabu	22. Ashfal
3. Jamainadu	13. Gopalbhog	23. Changai
4. Dorkumor	14. Ghigoj	24. Gunshi
5. BRRi Dhan-61	15. BRRi Dhan-23	25. BRRi Dhan- 54
6. Jataibalam	16. Akundi	26. Motabamonkhir
7. Kutipathai	17. Nonabokhri	27. Pokkali
8. Horkuch	18. Hogla	28. Birpala
9. Chiknul	19. Chinikanai	29. BRRi Dhan-55
10. BRRi Dhan-41	20. Brri Dhan-40	30. Barkful Balam



Development of sustainable technologies for improving nutrient and water efficiency in rice production.

PI: Dr. Md. Romij Uddin, Professor, Department of Agronomy, Bangladesh Agricultural University (BAU), Mymensingh.

Major Activities*:

	Planned Activities	Implementation Status
A.	Response of different sources of Nitrogen on crop performance and nitrogen use efficiency in rice Treatments: Factor A: Rice Cultivars: (4) BRRi dhan29, BRRi dhan59, Binadhan-8 and Binadhan-10 Factor B: Nitrogen source: (6) N ₁ - Control, N ₂ - 140 kg N ha ⁻¹ from	On-going BARC Monitoring was on 24-03-2016, 103th day from seed sown and 63 rd day from planting of seedlings.

	Prilled Urea (PU), N ₃ - 83 kg N ha ⁻¹ from Urea Super Granule (USG), N ₄ - 105 kg N ha ⁻¹ from PU + 3 t ha ⁻¹ Poultry manure, N ₅ - 112 kg N ha ⁻¹ from PU + 5 t ha ⁻¹ Cowdung, N ₆ - 77 kg N ha ⁻¹ from PU + 4 t ha ⁻¹ Vermi compost Seed sown date-12-12-2015, Seedlings planted- 21-01-2016.	
B.	Crop performance and water use efficiency of rice under different water management systems Factor A: Rice Cultivars: (5) BRRi dhan28, BRRi dhan29, BRRi dhan60, Binadhan-8 and Binadhan-10 Factor B: Water management: (4) I ₁ - Continuous saturation, I ₂ - Alternate flooding and wetting at 8 days after disappearance of 4 cm, I ₃ - Alternate flooding and wetting at 10 days after disappearance of 4 cm, I ₄ - BRRi recommended water management package Seed sown date-12-12-2015, Seedlings planted- 19-01-2016.	On-going BARC Monitoring was on 24-03-2016, 103th day from seed sown and 65th day from planting of seedlings.

Budgetary Information: i) Total Approved Budget, 2015-16 Tk: 4,00,000.00
ii) Fund released (to date) Tk: 2,00,000.00

iii) Fund spent (to date) Tk: 1,90,413.50

Any other Information: The on-station trials were running well according to experimental design.

Constraints & Suggestions:

Constraints	Suggestions
Unavailability of fund at appropriate time	Fund release should be on due time

Development of onion, ginger and garlic mutant varieties through induced mutation

PI: Dr. Md. Rafiqul Islam, Senior Scientific Officer and Head, Horticulture Division, BINA, BAU campus, Mymensingh-2202

Major Activities:

SI. No.	Planned Activities	Implementation Status (Progress from July 2015 to May 2016)		
1.	Germplasms collection	Germplasms of onion, garlic and ginger were collected from home and abroad: Total =25		
		Ginger germplasms:	Onion germplasms	Garlic germplasms
		Accessions=12 (i) Shilkhali (Bandarban) (ii) Lama (iii) Chokoria (iv) Maringa porzaton lama (v) Thanchi (vi) Roma Bandarban (vii) Syedpuri (Nilphamari) (viii) Dinajpuri Japbari, (ix) Taragonj Rangpur, (x) Amgonj Khanshama Dinajpur (xi) Khanshama Upazilla (xii) Khagrachari,	Accessions=9 (i) Faridpur , (ii) Taherpur (iii) Springer (iv) Indian (v) Onion- 2 (vi) Onion- 3 (vii) Onion- 4 (viii) Onion 9 (ix) Onion- 10 Summer onion accessions=5	Accessions=5 (i)BAU-1 (ii) BAU-2 (iii)BAU-3 (iv) BAU-4 (v) Chalanbil rason
2.	Radio-sensitivity Test	Seeds of onion, garlic were irradiated and that of ginger will be irradiated by gamma ray for the test of radio-sensitivity. Dose range was estimated for mutation induction. (Garlic= 3.0 - 4.0 Gy), (Onion= 80.0 - 100.0 Gy), (Ginger= 2.5- 3.0 Gy) Onion accessions= 14, Ginger accessions= 12 Garlic accessions= 5		
3.	Growing of M ₁ and M ₂ population experiment of Onion, and garlic	Experiments were conducted with onion and garlic for developing desirable mutants at Germplasm Centre, BAU, Mymensingh and BINA HQ farm. The garlic experiment has been harvested. They were selecting desirable mutants of garlic. The onion experiment is in flowering stage. Onion accessions = 9, Garlic accessions =5		
4.	Growing of M ₁ and M ₂ population of Zinger	Dose range are estimated for irradiation of Bulk seeds of Zinger. The BARI Ada-1 was irradiated (gamma) in 2014-15 season. The mutant developing experiments with zinger were conducted at Boyra char land which was adjacent to BINA and BINA HQ farm, Mymensingh in 2014-15 season. They will conduct an experiment for growing M ₂ population with M ₁ seeds in 1 st week of April 2016. Besides this, they have collected 9 germplasms and conserved in semi deep soil. These nine germplasms of zinger will be irradiated very soon for planting in Germplasm Centre, BAU, Mymensingh.		
5.	Onion	They collected 10 germplasms of summer onion seeds for screening experiment.		

Germplasms screening experiment in summer season	We will irradiate the seeds within 7 days for growing M1 population at GPC field Lab.
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Any other Information: Radio sensitivity test was done to establish the range of LD₅₀ and GR₅₀ for mutation induction. Irradiation of bulk seeds of onion and garlic will be irradiated at estimated LD₅₀ dose. Mutant screening experiment will be conducted in coming season.

Budgetary Information: i) Total Approved Budget, 2015-16 Tk. 4,00,000/-
 ii) Fund released (to date) Tk. 2,00,000/-
 iii) Fund spent (to date) Tk. 1,50,000/- till 20/03/2016

Constraints & Suggestions:

Constraints	Suggestions
i) Natural calamities like heavy rainfall, extreme drought rise (during	i) Scientists should be cautious about natural calamities. ii) BARC should

Major Activities:

	Planned Activities	Implementation Status
1.	Purchasing of research materials	Going on
2.	Preparation of rootstocks	Rootstocks were raised for vegetative propagation in 2014-15.
3.	Production of propagules/seedlings	Required numbers of propagules/seedlings were produced by vegetative propagation (grafting, budding) in 2014-15.
4.	Distribution of propagules/seedlings	In 2015-16, Each of 30 farmers was distributed 30 propagules of BARI released fruit varieties in 2 locations of Kaliakoir, Gazipur and Fulbaria,

experimentation) may damage the experiment. ii) Timely availability of fund iii) Timely supply and purchase of input materials.	release project fund timely. iii) PI should be active during procuring different items.
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Any other Information: Radio sensitivity test was done to establish the range of LD₅₀ and GR₅₀ for mutation induction. Irradiation of bulk seeds of onion and garlic will be irradiated at estimated LD₅₀ dose. Mutant screening experiment will be conducted in coming season.

Propagules/Saplings production and dissemination of BARI released promising fruit varieties

PI: Dr. Md. Jillur Rahman, Senior Scientific Officer, Pomology division, HRC, BARI, Joydebpur, Gazipur-1701.

		Mymensingh on 15-09-2015 and 20-09-2015, respectively.
5.	Tour/visit	Orchards of farmers were visited by the P.I. on 17 Feb. 2016 (Fulbaria), 13 & 31 March 2016 (Kaliakoir). BARC Team visited the Fulbaria site on 25-3-2016. Saplings planted in the farmer's field were in the growing stage and they were in good condition.
6.	Training	In 2015, two training programmes were conducted

Budgetary Information: i) Total Approved Budget, 2015-16: Tk. 4,00,000.00
 ii) Fund released (to date): Tk. 2,00,000.00

iii) Fund spent (to date): Tk: 1,32,744.50

Constraints & Suggestions:

Constraints	Suggestions
Fruit orchard needs high lands. Communication is a problem to find out suitable location.	High lands may be selected in the region with local SAO.

Any other Information: Farmers have established fruit orchard with the propagules of BARI released fruit varieties. Seedlings were in the vegetative stage.

Study of reproductive endocrinology of mud eel *Monopterusuchia* for artificial propagation

PI: Professor Dr. Mst. Kaniz Fatema, Department of Fisheries Management, Bangladesh Agricultural University (BAU), Mymensingh

Major Activities*:

	Planned Activities	Implementation Status
1.	Collection of brood from nature and domestication	45 kg 500 gm (180 nos.) <i>cuchia</i> was collected.
2.	Fry production by manipulating environment (Induced spawning)	Six <i>Cuchia</i> breeding pits were constructed by manipulating environment, five of which 9 sqm and one 12 sqm.
3.	Nursing of <i>cuchia</i> fry and trial on 'first feeding'	Feeding and nursery trial was done with 600 <i>cuchia</i> fry.
3.	Construction of small breeding ponds and stocking of broods for induced breeding	On-going

Major Activities:

	Planned Activities	Implementation Status
1.	Laboratory set up for algae production	Occupy laboratory space for algae culture, media preparation, aeration, electric supply etc. Preparation of algae production facilities.
2.	Establishment of algae culture	100% pure culture of <i>Sprulina</i> has collected from the Aquaculture Department of BAU. The culture was originated from Malaysia. Bulk culture grown in the sunlight.
3.	Procurement of chemicals, glassware, laboratory materials and others	Already conducted as per requirements.

	(natural breeding)	
4.	Captive maturation of breeders using exo-hormones	On-going
5.	Gonad histology, gonado-somatic index (GSI), fecundity and maturity estimation	On-going
6.	Study on hematology of <i>cuchia</i> reproduction:	On-going

Budgetary Information: i) Total Approved Budget, 2015-16 Tk:

ii) Fund released (to date) Tk: 2,00,000/-

iii) Fund spent (to date) Tk: 2,00,000/-

Constraints & Suggestions:

Constraints	Suggestions
Feed Expensive	Need to develop commercial feed
Slow growth during larval rearing in captivity	
Exo-hormone	Need to develop synthetic hormone

Any other Information: Artificial or induced breeding was unsuccessful last year. They are trying also this year.

Production of algae to use as environment friendly feed supplements for poultry

PI: Prof. Dr. Khan Md. Shaiful Islam, Department of Animal Nutrition, Bangladesh Agricultural University, Mymensingh-2202

4.	Production of bulk culture	About 100 liter bulk culture established.														
5.	Few feeding trial in broiler	Experimental broiler chickens (six groups): Age- 26 days on 24-3-2016 (Monitoring day).														
	a. algae spray in the feed along with media	<table border="0"> <thead> <tr> <th style="text-align: left;">Groups</th> <th style="text-align: right;">One Bird weight (gm)</th> </tr> </thead> <tbody> <tr> <td>Group 1 (100% premix+0% Spirulina):</td> <td style="text-align: right;">1000</td> </tr> <tr> <td>Group 2 (75% premix+25 % Spirulina):</td> <td style="text-align: right;">925</td> </tr> <tr> <td>Group 3 (50% premix+50% Spirulina):</td> <td style="text-align: right;">825</td> </tr> <tr> <td>Group 4 (25% premix+75% Spirulina):</td> <td style="text-align: right;">736</td> </tr> <tr> <td>Group 5 (0% premix+100% Spirulina):</td> <td style="text-align: right;">847</td> </tr> <tr> <td>Group 6: (0% premix + 0% Spirulina):</td> <td style="text-align: right;">590</td> </tr> </tbody> </table>	Groups	One Bird weight (gm)	Group 1 (100% premix+0% Spirulina):	1000	Group 2 (75% premix+25 % Spirulina):	925	Group 3 (50% premix+50% Spirulina):	825	Group 4 (25% premix+75% Spirulina):	736	Group 5 (0% premix+100% Spirulina):	847	Group 6: (0% premix + 0% Spirulina):	590
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Group 5 (0% premix+100% Spirulina):	847															
Group 6: (0% premix + 0% Spirulina):	590															
	b. algae in the drinking water															

Budgetary Information: i) Total Approved

Budget, 2015-16: Tk: 4,00,000/-

ii) Fund released (to date) Tk: 2,00,000/-

iii) Fund spent (to date)

Tk: 2,00,000/-

Constraints & Suggestions:

Constraints	Suggestions
Budget is not sufficient	The problem may be discussed with BARC Authority

Any other Information: In Chicken experiments, at 26 days old, weights of birds taking algae in different concentrations were not obtained as expected and were less than that of Group 1 (100% premix). Weight of the positive control birds (Group 1) at the same age were also seemed to be lower compared to the commercial birds. These results might be due to low quality birds, feeds and other factors. The P.I. said, source of birds and strain needed to be changed. He will start works with layer birds soon.

Administrative activities with BAURES and BARC:

Formation of buying committee, opening bank account, get approval from BAURES, recruitment of worker and set the student for experimentation.

Establish of algae culture

There are three procedures for isolation of microalgae from aquatic habitats. These are:

Pure but old *Spirulina* culture was collected from the department of aquaculture, BAU. Initially a small part of the culture was poured into the media as described in table 1. The media was prepared to obtain clonal cultures; the culture was propagated from a single filament of a few cells. For instance, general enrichment cultures established to allow the entire algal population.

Take all these measured chemicals in 1.0 L Volumetric Flask and make 1.0 volume with distilled/double distilled/deionozed water in respect to availability. All the glass wires was washed with detergent and then sterilized with dry heat in oven at 70°C overnight.

After autoclave, keep the machine off for cooling at normal temperature. Then take out the flasks from the machine. After autoclaving the media is ready for culture *Spirulina* at laboratory scale.

Molecular characterization of *B. anthracis* isolated from the field cases of Bangladesh and selection of vaccine candidates

PI: KHM Nazmul Hussain Nazir, PhD, Associate Professor, Department of Microbiology and Hygiene, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh-2202

Major Activities:

	Planned Activities	Implementation Status
1.	Sample collection and isolation of <i>B. anthracis</i> from the field samples	Ongoing: A total of 184 soil samples were collected from Pabna, Serajgonj, Kustia and Borguna, and 3 other samples from Pabna and Serajgonj, A total of 108 soil samples and 2 other samples were checked, of which 21 (19.44%) soil samples and 2 (100%) other samples were positive to <i>Bacillus anthracis</i> .
2.	Molecular characterization of	Ongoing: New primers were designed for the

the existing and new field isolates	plasmids, pX01 and pX02 and for the genome of <i>Bacillus anthracis</i> . PCR identification of <i>Bacillus anthracis</i> from soils revealed the presence of 596-bp fragment of pX01, 846-bp fragment of pX02, and 639-bp fragment of <i>Bacillus anthracis</i> genome.
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- Budgetary Information:**
- i) Total Approved Budget, 2015-16: Tk: 4,00,000/-
 - ii) Fund released (to date): Tk: 2,00,000/-
 - iii) Fund spent (to date): Tk:1,88,620/-

Constraints & Suggestions:

Constraints	Suggestions
Unavailability of BSL-3 Lab.	This was discussed before that the Facility in IEDCR will be used.
Fund is not sufficient for conducting molecular works and the existing fund is also not released timely.	BARC should take care of it.

Any other Information: The fragment of 846-bp is 207-bp larger than 639-bp fragment, but in gel photograph these two fragment bands were close, that requires repetition of pursuing PCR with size marker at both left and right ends of the gel.

Monitoring Report of Team-5

The team members were Md. Abeed Hossain Chowdhury, Director (Computer & GIS), BARC (Team Leader, Dr. Rina Rani Saha, PSO (Crops), BARC and Dr. Md. Saifullah, PSO (Forestry), BARC. A three member monitoring team (Team-5) formed by Planning & Evaluation division of BARC was assigned with the responsibility to monitor the implementation progress of the research projects (2015-2016) under “Research Grant” of BARC conducted at different locations of Rangpur, Dinajpur, Kurigram, Nilphamari and Lalmonirhat districts.

The team members paid a visit to Rangpur, Dinajpur and Nilphamari districts during 7-10 March 2016 to monitor the implementation progress of research

activities of 5 (five) on-going projects. However, the team did not monitor the activities of 4 (four) projects in Kurigram and Lalmonirhat district as there was no research activities at the field during that time. The projects visited by the monitoring team are being implemented by the researchers of Bangladesh Agricultural Research Institute (BARI), Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Cotton Development Board (CDB), Hajee Mohammad Danesh Science and Technology University (HSTU). The Principal Investigator or Co-Principal Investigator of the respective projects were accompanied with the monitoring team during the field visit. The financial and technical progress reports of the respective project were collected in the well-structured monitoring format provided by the Planning & Evaluation division of BARC. The farmers involved in the demonstration trials for dissemination of research technology at one location were also interviewed by the team members during the visit to record their views. A total of 5 projects were monitored by the team

Quality seed/propagules production and dissemination of BARI released flower varieties in Bangladesh

PI: Dr. Kabita Anzu-Man-Ara, Principal Scientific Officer, Floriculture Division, HRC, Bangladesh Agricultural Research Institute, BARI, Gazipur.

On 8 March, 2016 the team members monitored the implementation progress of four projects by visiting the field level activities of three projects at different locations of Rangpur and one project in Saidpur. Firstly, the team visited the activities of the project titled “Quality seed/propagules production and dissemination of BARI released flower varieties in Bangladesh” being implemented by the Principal Investigator Dr. Kabita Anzu-Man-Ara, PSO, Floriculture Division, Horticulture Research Centre of Bangladesh Agricultural Research Institute (BARI). It is to be mentioned that one of the location of the projects in Rangpur and the activities is being managed by the scientist Dr. Md. Obaydur Rahman, SSO, RARS, Burirhat, Rangpur. During the field visit, the Principal Investigator briefed the team members on overall activities and implementation progress of the project.

The team members visited the farmer’s field where demonstration trial of BARI released flower varieties and technology dissemination has been conducted.

There were two demonstration plot of flower, one Gladiolus and another Gada. In one plot, the farmer cultivated BARI Gladiolus 1, BARI Gladiolus 2 and one variety collected from commercial market. The performance of BARI Gladiolus 1 and BARI Gladiolus 2 were found significantly better than the commercial variety. The farmer was extremely satisfied with BARI Gladiolus 1 and BARI Gladiolus 2 and expressed his strong desire to cultivate the same in the next year. In another demonstration plot, the farmer cultivated BARI Gada 1 and a commercial variety. BARI Gada 1 showed excellent performance compare to the commercial variety. BARI Gada 1 produced professed flower with prolong flowering time and harvested upto

150 flower per plant. While talking to the farmers it was observed by the team members that they were very happy with the performance of BARI released flower varieties. The farmers also informed the team about the knowledge and skills they acquired under the project for quality seed/propagules production. In the end the team members held a meeting with Chief Scientific Officer and Station In-charge of Regional Agricultural Research Station, Burirhat, Rangpur and discussed about the success made under this project, adoption of BARI released flower varieties and the production technology and more importantly the need for future expansion of flower cultivation in the region.



Demonstration of BARI Gada 1 at farmer's field in Rangpur



Demonstration of BARI Gladiolus 1 at farmer's field in Rangpur

Bio-efficacy evaluation of different botanical extract against cotton sucking insects

PI: Mr. A.B.M. Rezaur Rahman, Senior Officer (Entomology), Cotton Research, Training and Seed multiplication Centre, Sreepur, Gazipur

Thereafter, the team members visited the activities of the project titled "Bio-efficacy evaluation of different botanical extract against cotton sucking insects". The objectives of the project was to develop bio-rational based integrated management package(s) against different sucking pest of cotton and to know the effectiveness of spraying botanical extract against the infestation by sucking pest of cotton. The Principal investigator of this project was A. B. M. Rezaur Rahman, Senior Officer (Entomology), Cotton Research, Training and Seed Multiplication Center, Sreepur, Gazipur. The research was conducted in the experimental field of Cotton Development Board, Rangpur farm. In this trial the effectiveness of different

types of botanical pesticides were examined for controlling various types of sucking pest of cotton. The team members visited the experimental field and observed that the neem bio-pesticide is more effective for controlling sucking pest of cotton compare to other botanical pesticides.



Photo 3: Visiting Cotton field at CDB farm in Rangpur

Development of short duration, high yielding aromatic rice variety suitable for three growing seasons of Bangladesh

PI: Professor, Dr. M. Moynul Haque, Director (Outreach Program), BSMRAU, Gazipur, Salna-1706

The team members then visited another project in Rangpur being implemented by Prof. Dr. M. Moynul Haque, Director (Outreach Program), Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur. The research was conducted in the experimental field of Bangladesh Jute Research Institute (BJRI) in Rangpur. The title of the project is “Development of short duration, high yielding aromatic rice variety suitable for three growing seasons of Bangladesh”. The objective of the project was to evaluate yield potential of advanced line of aromatic rice in different regions of the country. The team member visited the experimental field with the station in-charge of BJRI, Rangpur Dr. Md. Abul Fazal Mollah, Principal Scientific Officer. The team found that the crop condition was good but the control variety was better than the selected line. The plant population of the selected line of aromatic rice was less in field.



Aromatic rice experimentation at BJRI research

Seed production of endangered *Cirrihinusreba*: potential as a new aquaculture species and for its revival

PI: Imran Parvez, Associate Professor, Department of Fisheries Biology and Genetics, Hajee Mahammad

Danesh Science and Technology University, HDSTU, Dinajpur

On March 9, 2016, the team members visited two project activities executed by the researchers of Hazi Mohammad Danesh Science and Technology University (HSTU), Dinajpur.

The project titled “Seed production of endangered *Cirrihinusreba*: potential as a new aquaculture species and for its revival” was implemented by Principal Investigator Dr. Imran Parvez, Associate Professor, Department of Fisheries Biology and Genetics, HSTU, Dinajpur. The goal of this research projects is to develop the seed production technology of endangered *C. reba* and its culture management in order to bring this fish species under aquaculture and restoration in the natural habitats to revive them from the threats of being extinction. The field trial of the project was conducted at Bangladesh Fisheries Research Institute (BFRI), Saidpur. On March 8, 2016, the team member visited the research activities and the ponds with Dr. Imran Parvez and the scientists of BFRI where the seed production technology and culture management were carried out. The present work was rearing of existing brood stock, collection of new brood fish stock, fingerling rearing which produced in the last year, preparing for induced breeding, histology for the study of ovarian development. The Principal Investigator of the project briefed the team members about the success made in carrying out the research activities of the project. The team members expressed its satisfaction while monitoring the research activities of the project at the BFRI research station.



Visiting research activities at BFRI station ponds in Saidpur

On March 9, the team visited the research laboratory of Department of Fisheries Biology and Genetics at Hajee

Mohammad Danesh Science and Technology University. The research work like food and feeding habit, reproductive biology and other aspects were carried out in the laboratory. The team also observed the laboratory equipment those were purchased by the project grant.



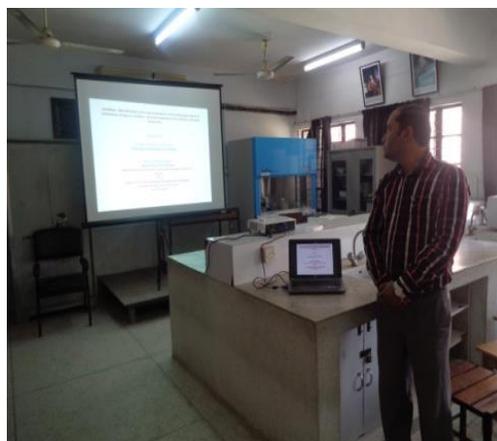
Fisheries research lab visit at HSTU, Dinajpur

Isolation, Identification and characterization of the etiological agent of infectious coryza in chicken and development of its effective remedial measures

PI: Prof. Dr. Md. Mostafizer Rahman, Dept. of Microbiology, Faculty of Veterinary and Animal Science, Hajee Mohammad Danesh Science and Technology University, HDSTU, Dinajpur

In the same day, the team members visited the research activities of the project titled "Isolation, Identification and characterization of the etiological agent of infectious coryza in chicken and development of its effective remedial measures" in HSTU. The project is being implemented by Dr. Md. Khalesur Rahman, Assistant Professor, Department of Microbiology, Faculty of Veterinary and Animal Science, HSTU, Dinajpur. The objectives of the project are (i) to isolate and identify the etiological agent of infectious coryza from suspected and infected field cases based on age, sex, breed, spatial and temporal differences, (ii) to characterize the isolated etiological agent of infectious coryza by using cultural, biochemical, serological, antibiogram study and molecular techniques and (iii) develop vaccine candidate from the field isolate to control infectious coryza in chicken. The team visited the research laboratory and observed a power point presentation on the project activities and vaccine development process along with its effectiveness for

controlling infectious coryza in chicken. The effectiveness of the vaccine was tested in experimental layer birds and the outcome was real encouraging. The implementation progress of the project was satisfactory.



Presentation at microbiology lab in HSTU, Dinajpur

Observations

There are some observations from the team members on the activities of the projects which areas follows. Seedling mortality is higher for the selected line of aromatic rice in Boro season probably due to environmental stress e.g. cold injury due to cool temperature. The efficacy of the developed vaccine for combating infectious coryza in chicken will remain unresolved until and unless further investigation is conducted in a broader scale e.g. chicken farm. Collection of brood from other parts of the country would be helpful for development of an improved brood fish stock of the species *cirrihinusreba*.

Conclusion

The growth and yield of BARI Gladiolus 1, BARI Gladiolus 2 and BARI Gada 1 were found very encouraging at the time of monitoring and the same view echoed by the farmers. The flower varieties and the technology may be demonstrated in large scale in other areas of the country. Bio-pesticides application performed well for controlling various types of sucking pest of cotton. In future, more study may be taken up to figure out the effectiveness of applying bio-pesticides in other crops. The performance of selected line of aromatic rice in the Boro season was not satisfactory. The reason may be

cold weather, so, other line of aromatic rice may be experimented in the region during Boro season.

The vaccine developed as an effective remedial measures to fight infectious coryza in chicken should be demonstrated at farmers' field.

Monitoring Report of Team-7

The team members were Dr. Kabir Iqramul Haque, Member-Director (Fisheries), BARC (Team Leader), Dr. S. M. Khorshed Alam, PSO (Crops), BARC and Dr. S. M. Bokhtiar, PSO (Soils), BARC. A three member monitoring team (Team-7) formed by Planning & Evaluation division of Bangladesh Agricultural Research Council (BARC) was assigned with the responsibility to monitor the implementation progress of the research projects (2015-2016) under "Research Grant" of BARC conducted at different locations of Monitoring Team-7 visited Natore, Jessore and Duttanagar Farm during 07-09 March, 2016. The team collected necessary information by discussion with the concerned and associated scientists, scientific assistant and farmers of the respective project and visited the experimental field. The team monitored 4 projects.

Adaptive Trials on Newly Developed Promising Varieties of Aroids at Different AEZ of Bangladesh

PI: Dr. Md. Khaillur Rahman Bhuiyan, Principal Scientific Officer, Tuber Crops Research Centre, BARI, Gazipur.

Major Activities:

	Planned Activities	Implementation Status
1.	Farmers selection	Done
2.	Training program	Will be arranged
3.	Seed, Fertilizers & Chemical procurement	Done
4.	Land preparation	Done
5.	Seed sowing	Will be Done
6.	Procurement of oil, fuel and Lubricants	Will be Done
7.	Procurement of office supplies and contingencies	Will be Done

Present status/Research: Planting/sowing stage

Location wise activities during 2014-2015:

July 2014-June 2015

- i) Twenty farmers (2 farmers from each location) from Melandah (Jamalpur) and Nalitabari, Kushumhati (Sherpur), Jessore, Jhenidah, Pahartali, Comilla, Joypurhat, Gazipur and Rajshahi, have been selected for demonstration. The demonstration plot size was 10 sqm for each variety. So, land area for each farmers was 40 sqm for four varieties.
- ii) Seed, fertilizers and chemical procurement has been completed.
- iii) Training program for two batches (each batch containing 10 farmers) has been accomplished.
- iv) Suckers of four varieties of Panikachu (BARI Panikachu 2, 3, 4 and 5) have been distributed to the farmers.
- v) Land preparation, transplanting of suckers in the demonstration field has been completed.
- vi) Crops establishment and the rate of survival was more than 90%.
- vii) Data on stolon production of Panikachu varieties were being collected from different locations
- viii) Data on plant height, disease and insect infestation of Mukhikachu has been taken
- ix) Fertilizer and pesticides have been purchased and duly supplied to the farmers of each trial
- x) Signboard and labelling of the varieties in the farmers trial plot have also been accomplished.
- xi) Training on "production of improved varieties of taro" have been conducted on 17th may 2015 at Joydebpur.
- xii) Supervision and monitoring is being continued

Budgetary Information: i) Total Approved Budget, 2015-16 Tk: 4,00,000/-
 ii) Fund released (to date) Tk: 2,00,000/-
 iii) Fund spent (to date) Tk: 2,00,000/-

Development of short duration, high yielding aromatic rice variety suitable for growing three seasons of Bangladesh.

PI: Prof. Dr. M. Moynul Haque, Director (Outreach Program), Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur 1706

Major Activities:

	Planned Activities	Implementation Status
1.	Establishment of rice in Aman season	Completed
2.	Data recording of Aman rice	Completed

3.	Data management of Aman rice	On-going
4.	Establishment of rice in Boro season	Completed
5.	Management of Boro rice	On-going

Present status/Research: Present rice in Boro season is at early vegetative stage.

Location wise activities during 2015-16: The activities mentioned above are going on in all the locations.

Budgetary Information:

- i) Total approved budget, 2015-16 Tk: 4,00,000/-
- ii) Fund released (to date) Tk: 2,00,000/-
- iii) Fund spent (to date) Tk: 1,65,000/-

Constraints & Suggestions:

Constraints	Suggestions
Seedling mortality is common in Boro season	Number of seedling per hill should be higher under cold weather
Bird attack is severe in Aus season	Cultivation of rice in block is suggested during Aus season
Availability of supplement irrigation is difficult	Enhancement of social concern is essential

Development of fertilizer package for four crop based cropping pattern in rice based cropping system

PI: Dr. Md. Abdul Aziz, Chief Scientific Officer, Agronomy Division, BARI, Joydebpur, Gazipur-1701

Major Activities:

	Planned Activities	Implementation Status
1.	CP ₁ = Mustard –	Mustard harvested

	Spinach – Mungbean – T. Aus –T. Aman	and data collected and Spinach at harvesting stage
2.	CP ₂ = Potato – Spinach – Mungbean – T. Aus –T. Aman	Potato and Spinach harvested and data collected

- Budgetary Information:**
- i) Total Approved Budget, 2015-16 Tk: 4,00,000/-
 - ii) Fund released (to date) Tk: 2,00,000/-
 - iii) Fund spent (to date) Tk: 1,81,086/-

Any other Information: The project “Development of fertilizer package for four crop based cropping pattern in rice based cropping system” completed one cycle in 1st year with the cropping patterns: CP₁ = Mustard – Boro – T. Aus – T. Aman; CP₂ = Potato – Boro –T. Aus – T. Aman; CP₃ =Mustard – Mungbean –T. Aus – T. Aman

After one year it was observed that similar type of project have also been started by Soil Science Division, BARI and OFRD, BARI funded by KGF. For this reason the Director General of BARI suggested to conduct research on “Development of fertilizer package for five crop based cropping pattern in rice based cropping system” as Agronomy Division, BARI developed five crop based cropping pattern. That is why the title and activities of the project have been changed.

Constraints to the Development of Selected Small-scale Agribusiness Enterprises in Bangladesh

PI: Dr. Shaikh Abdus Sabur, Professor, Dept. of Agribusiness and Marketing, Bangladesh Agricultural University, Mymensingh.

Implementation Locations: Details of Study Area for Medicinal and Aromatic Plant Enterprises

Selected Enterprises	District	Upazila	Union	Villages	Selected Species
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Medicinal plants (MPs) Enterprises	Natore	Natore Sadar	Laxmipur-kholabaria	Laxmipur, Kathaalbaria, Ibrahimpur, Chauri, Darabpur	Kholabaria, Borabaria, Dakhinpur, Hoybatpur,	Amrul, Basak, Ghritokumary, Hostipolas, Kalomegh, Misridana, Owshaganda, Shatamul, Shimulmul and Tulsi
Aromatic plant Enterprises	Moulabi Bazar	Barlekha	Ten unions	Barlekha Sadar, South Sahbagpur, North Sahbagpur, Niz Bahadur, Barni, Talimpur, North Dakhinbag (Katalthali), South Dakhinbag, Sujanagar, Dasher Bazar		Agar Plant

Major Activities:

Sl. No.	Planned Activities	Implementation Status
01.	Project proposal revised	Completed according to the comments of BARC, December 2014.
02.	Procurement	Desk computer, laptop computer, printer and digital camera were procured in February 2015.
03.	Literature Review, relevant documents /papers collection and other desk works	Continued up to today.
04.	Study areas visit and selection	Study areas were selected based on Visit by PI and Co-PI of the project and the Monitoring Team of BARC from December 2014 to November 2016.
05.	FGDs implementation	Implemented two FGDs; One in each study area.
06.	Base (Basic) information collection	Collected through the implementing FGDs and through interview of several lead entrepreneurs by using checklist and schedule.
07.	Paper presentation on technical progress	Annual progress and review seminar, BARC, June 2015
08.	Edition of leaflet on the project activities	Completed in June 2015
09.	Expert seminar for suggestion of the project design and implementation	Organized on January 2016 in the conference Room of Dean office, Faculty of Agricultural Economics and Rural

		sociology, BAU, Mymensingh.
10.	Questionnaire/schedule developed and preparation	Questionnaires/schedules are developed and prepared. Total types of Questionnaires - 10 (ten).
11.	Questionnaire pretesting and finalization	Questionnaires are pretested and finalized.
12.	Collection of primary data	Initial stage and continued.
13.	Research paper publication based on the collected basic information	Submitted to "Bangladesh Journal of Political Economy", Bangladesh Economic Association, Dhaka, Bangladesh for publication.
14.	Developing and preparation of 'Small Medicinal Plant Entrepreneur Directory' based on Luxmipur-Kholabaria Union, Natore Sadar, Natore	Preparation of the Directory is going on.

Budgetary Information: i) Total Approved Budget, 2015-16 Tk: 4,00,000/-
ii) Fund released (to date) Tk: 2,00,000/-
iii) Fund spent (to date) Tk: 2,00,000/-

Constraints & Suggestions: Delay in fund release; Fund to be released individually for each project

Monitoring Report of Team-8

The team members were Dr. Md. Abdus Satter, CSO (Soils), NRM, BARC, (Team Leader), Dr. Nazmun Nahar Karim, PSO (Eng.), NRM, BARC and Dr. Kabir

Uddin Ahamed, PSO (P & E), BARC. A three member monitoring team (Team-8) formed by Planning & Evaluation division of Bangladesh Agricultural Research Council (BARC) was assigned with the responsibility to monitor the implementation progress of the research projects (2015-2016) under “Research Grant” of BARC conducted at different locations of Monitoring Team-8 visited Barisal, Bhola, Jhalokathi and Patuakhali Districts Farm during February 28 to March 3, 2016. The team collected necessary information by discussion with the concerned and associated scientists, scientific assistant and farmers of the respective project and visited the experimental field. A total of 7 projects were monitored by the team.

Organic Amendments in Mungbean-T. aus-T. aman cropping pattern for sustaining the yields and soil fertility in Southern Region of Bangladesh

PI: Dr. Babu Lal Nag, Principal Scientific Officer, Regional Agricultural Research Station, Bangladesh Agricultural Research Institute, Rahmatpur, Barisal

Major Activities:

Planned Activities Implementation Status (In details)

Sl. No.	Planned Activities	Progress
1	Site selection	Completed
2	Farmer’s selection	Completed
3	Farmers’ training	Not completed
4	Procurement and supply of inputs (seeds, fertilizers, manures etc.)	Completed
5	Set up and implementation on-farm trials on Mungbean-Taus-T. aman	1 st cycle completed 2 nd cycle 1 st crop on-going
6	Data collection, analysis and report preparation	2 nd yr not completed
7	Preparation of annual for presentation at BARC	Not completed

Budgetary Information:

- i) Total Approved Budget, 2015-16: Tk. 4,00,000/-
- ii) Fund released (to date): Tk. 1,00,000/-
- iii) Fund spent (to date): Tk. 1,00,000/-

Any other Information:

The Monitoring Team visited the experimental fields of Barisal on February 29, 2016 and Bhola on March 1, 2016. The PI of the project has been transferred from RARS, Rahmatpur, Barisal. Mr. Rajiuddin, SO, Agronomy Division, RARS, Rahmatpur, Barisal attended the Monitoring Team at Barisal and Mr. Md. Shahidul Islam, SSO, OFRD, Bhola attended the Team at Bhola. The team collected some information from the office of the concerned scientists and then visited the field.

Field Observation

- Crop: Mungbean, 2nd year
- Conducted at two locations (Barisal and Bhola) as per PP.
- At Bhola, the study area was selected properly but at Barisal site selection was not properly done. The selected areas are not *Aus* growing areas and some plots are beside a brick kiln.
- The crop was sown in line, germinated well at both the locations, at vegetative stage (about 1 month old), densely populated at Barisal, weed infested at Barisal, thinning and weeding were being done at Bhola.
- There was no project document at OFRD office, Bhola. The OFRD scientist did not know details about the project.
- At Bhola all the treatments were not accommodated properly in a replication/block, there was defect in experimental design.
- Only 5 and 8 replications (dispersed) were done at Bhola and Barisal out of 15 and 10 replications as mentioned in the PP, respectively. Distance between replications was too far, especially at Barisal.
- Farmer Training and Field Day were not done as per activity chart.
- Signboard was not visible from the nearby road at Barisal
- PI of the project was transferred from RARS, Rahmatpur, Barisal

Remarks

- The project activities should be done as per project protocol. However, the PI informed that the number of replication at Bhola was reduced with verbal consent from BARC.

- ‘Field demonstration’ written in Methodology should be changed with ‘On-Farm Trial’
- At Bhola, all the treatments should be accommodated in a replication/block.
- Suggested immediate thinning and weeding at both the locations;
- Field visit and monitoring should be done at least once in each cropping season.
- Signboard should be visible from the nearby roads.
- The issue of PI should be taken into account and resolved.

Increasing fertilizer and irrigation water use efficiency for crop production in southern coastal saline soils of Bangladesh.

PI: Dr. Mohammad Asadul Haque, Associate Professor, Department of Soil Science, Patuakhali Science and Technology University, Dumki, Patuakhali.

Major Activities:

Sl. No.	Planned Activities	Progress
1.	Increasing water use efficiency using polythene mulch to reduce salinity induced crop loss in maize	On-going
2.	Increasing water use efficiency using polythene mulch to reduce salinity induced crop loss in sunflower	On-going
3.	Development of appropriate soil management technologies for increasing water use efficiency in sweet gourd at coastal fallow saline soils of Bangladesh	On-going
4.	Development of appropriate soil management technologies for increasing water use efficiency in melon in coastal fallow saline soils of Bangladesh	On-going
5.	Development of appropriate soil management technologies for increasing water use efficiency in water melon in coastal fallow saline soils of Bangladesh	On-going
6.	Increasing nitrogen fertilizer use efficiency for cultivation of tidal water flooded <i>T. Aman</i> rice in southern saline soils of Bangladesh	Harvested
7.	Increasing nitrogen fertilizer use efficiency for cultivation of deep water flooded <i>T. Aman</i> rice in tidal non-saline soil of Bangladesh	Harvested

Budgetary Information:

- Total Approved Budget, 2015-16 Tk: 2,77,500/- (+ carryover 65,231)
- Fund released (to date) Tk: 1,38,750/- (1st and 2nd quarter)
- Fund spent (to date) Tk: 1,05,010/-

Any other Information

The Monitoring Team visited Patuakhali Science and Technology University (PSTU), met with the project personnel, collected some information and then visited the experimental fields at Kuakata, Patuakhali on March 2, 2016. The PI and Co-PIs of the project attended full time with the team at the University and also during field visit. The PI informed that the last years Monitoring Team suggested some modifications in the PP. The original PP included both field and pot experiments on maize and sunflower but the team suggested to drop the pot experiments; and instead, to

include field experiments on some additional crops like sweet gourd, musk melon and water melon. As per the suggestions the pot experiments have been dropped and only field experiments have been done this year on maize, sunflower, sweet gourd, musk melon and water melon. A Field Day was organized beside the experimental field at the time of field visit. About 25-30 farmers of the area attended the program and visited the experiment. Farmers were impressed to see excellent crop performance with different mulch management. There was a nice discussion with the participating farmers on salinity management and growing crops in the saline area.

Field Observation

- Crops: Maize, Sunflower, sweet gourd, melon and water melon.
- Different mulch materials like rice straw, blue polythene, black polythene and transparent polythene

were used as treatment and compared with no mulch (Control) treatment.

- A measured amount of water, 500 ml/plant was applied.
- Performance of all the crops with polythene mulch was found better than that with rice straw mulch; and much better than that without mulch.
- There was weed growth under the transparent polythene mulch but no weed growth under colored polythene mulch.
- Experimental location was far away from PSTU. Intensive data collection was very difficult.
- The method of determining “Irrigation water use efficiency” as mentioned in the PP is not proper.

Remarks

- The revised PP should be approved.
- Method of determining irrigation water use efficiency should be revised.
- Use of polythene mulch seems to be promising for growing crops in the saline area. This might be good for pit based crops but may not be practicable for closely planted field crops.
- More studies might be conducted on pit based crops with different sizes of colored polythene.

Tracking Climate Resilient Rice varieties Developed by BRRI and Its Economic Performances at the farm Level in Bangladesh

PI: Dr. Md. Abu Bakr Siddique, CSO and Head, Agricultural Economics Division, BRRI, Gazipur.

Major Activities:

Survey was conducted at Mymensingh, Rajshahi, Satkhira and Bakergonj in *Aman* season during 2015-16. Total 140 respondents of four districts were interviewed randomly with the help of trained enumerators.

Budgetary Information:

- i) Total Approved Budget, 2015-16: Tk. 4,00,000/-
- ii) Fund released (to date): Tk. 1,00,000/-
- iii) Fund spent (to date):

Constraints

- i) Lower diffusion rate of stress tolerant varieties to the farmers.
- ii) Difficult to trace the respective respondents.
- iii) Lack of awareness about the stress tolerant varieties

Any other Information

The Monitoring Team visited the Regional Station of BRRI at Shagardi, Barisal on 29-02-16; discussed with the Co-PI Mrs. Afroza Chowdhury, SO, Agril. Economics Division, BRRI, Gazipur, noted some major information on the project activities and then visited to the study site at Bakerganj along with the Co-PI. The team met with a group of 15 respondent farmers at Bakerganj, discussed with them regarding the collected information. The team also discussed regarding salinity of the area, salt tolerant crops/varieties and agricultural production system of the area as whole. The major Observations of the Monitoring Team are as follows:

Major observations

- 1) Mrs. Afroza Chowdhury did not know about her involvement as Co-PI in the project. She did not even see PP of the project before.
- 2) The study area was not properly selected. Barisal and Jhalokathi are mentioned in the PP for the study under saline prone area. The study was conducted at Bakerganj, which is not a saline area. The Co-PI could not explain why the study was conducted in the non-saline area of Bakerganj.
- 3) The study was targeted to cover saline prone area. But the farmers of the area told that Bakerganj is not a saline area. BARI scientists working in the region and teachers of PSTU also told that Bakerganj is not at all a saline area. So there was wrong selection of the study area and total wastage of manpower, time and money spent for the study.
- 4) In the PP it is mentioned that “Focus Group Discussion (FGD) and Participatory Rural Appraisal (PRA) technique will be employed in tracking the adoption status, performances and constraints of the existing stress tolerant varieties in the study area”. But FGD and PRA have not been done at all.
- 5) As per Activity Chart in PP data collection should be completed by December 2015 from all the study locations. The study should cover a total of 900 farmers from 10 districts but only

140 farmers from 4 districts were completed until February 2016.

- 6) The survey was supposed to be done in *Boro*, *Aus* and *Aman* seasons. But the study was done only on *Aman* season; *Boro* and *Aus* seasons were not covered at all.
- 7) The Survey Questionnaire was not developed properly.

- o There was no question on Soil/Water salinity and their effect on crop productivity,
- o No question on salt tolerant variety
- o No question on problems faced in crop cultivation due to salinity
- o There is no 'Unit' in answer part of most of the questions.
- o There is no provision in the Questionnaire for collecting information from more than one plot of a farmer *i.e.* there is no provision in the Questionnaire for collecting individual plot information of a farmer.

iv) to conduct FGD and PRA for collecting information as mentioned in the PP.

For the survey projects provision might be made for submission of 'Survey Questionnaire' with Project Proposal (PP) and approved by BARC along with PP to avoid major mistakes.

Monitoring Report of Team-9

The team members were Mr. Md. Aminuzzaman, Director (Manpower and Training Unit), BARC (Team Leader), Dr. MD. Abdul Awal, CSO (cc), P&E, BARC. A two member monitoring team (Team-9) formed by Planning & Evaluation division of BARC was assigned with the responsibility to monitor the implementation progress of the research projects (2015-2016) under "Research Grant" of BARC conducted at different locations of Monitoring Team-8 visited Comilla, Hathazari, Bandarban and Raikhali Districts Farm during February 7 to 12 March, 2016. The team collected necessary information by discussion with the concerned and associated scientists, scientific assistant and farmers of the respective project and visited the experimental field. A total of five project were monitored by the team. The description of the activities of the respective institutes is as follows:

Remarks

The Monitoring Team suggested immediate actions-

- i) to complete the survey (covering 900 farmers) as soon as possible.
- ii) to revise the Survey Questionnaire considering the points mentioned in 9.7.
- iii) to select proper study location and re-conduct the study in all the growing seasons (*Aus*, *Aman* and *Boro*) as mentioned in the PP.

Adaptive trials on newly developed promising varieties of aroids at different AEZ of Bangladesh

PI: Dr. Md. Khaillur Rahman Bhuiyan, Principal Scientific Officer, Tuber Crops Research Centre, BARI, Gazipur.

Implementation Locations:

Sl.No.	Particulars		Details	
1.	Farmer's name	:	Md. Lutfor Rahman	Md. Mustafa Kamal
2.			Village- Matiara Union- Shilmori Upazill- Barura District- Comilla	Village- Chandimura Union- Shilmori Upazill- Barura District- Comilla
3.	Land area	:	330 m ² (Each Variety 9m x 4.5m)	140 m ² (Each Variety 9m x 6m)
4.	Variety	:	BARI Panikachu-1, BARI Panikachu-2, BARI Panikachu-3, BARI Panikachu-5 and Local Variety	BARI Mukhikachu-2 and Local Variety
5.	Date of planting	:	16 March 2016	06 March 2016
6.	Present status of	:	Vegetative Growth stage (first time	Vegetative Growth stage

	crop		stolen harvested)	
7.	Others (if any)	:	Crop condition excellent. For controlling red mite miticide spray was done	Crop condition excellent.

Major Activities:

Sl. No.	Planned Activities	Progress
1.	Site selection	Completed
2.	Farmer's selection	Completed
3.	Land preparation	Completed
4.	Sucker planting	Completed (06/03/2016)



Development of short duration, high yielding aromatic rice variety suitable for growing three seasons of Bangladesh.

PI: Prof. Dr. M. Moynul Haque, Director (Outreach Program), Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur 1706.

Major Activities:

	Planned Activities	Implementation Status
1.	Establishment of rice in Aman season	Completed
2.	Data recording of Aman rice	Completed
3.	Data management of Aman rice	On-going
4.	Establishment of rice in Boro season	Completed
5.	Management of Boro rice	On-going

Budgetary Information

- i) Total Approved Budget, 2015-16: Tk.4,00,000
- ii) Fund released (to date): Tk.1,00,000
- iii) Fund spent (to date): Tk.1,00,000

Constraints & Suggestions

Constraints	Suggestions
Farmers planting seedling earlier than us	Seedling supply proper time
Red mite, Caterpillar attacked were found	Miticide and insecticide were applied for controlling
Previous year, foot rot and blight disease were observed	Fungicide were sprayed for controlling the disease
More demonstration should be conduct	-
Delay fund release	Fund should be released timely.

Present status/Research: Present rice in Boro season is at early vegetative stage.

Budgetary Information:

- i) Total approved budget, 2015-16 Tk: 4,00,000/
- ii) Fund released (to date) Tk: 2,00,000/-
- iii) Fund spent (to date) Tk: 1,65,000/-

Constraints & Suggestions:

Constraints	Suggestions
i). Seedling mortality is common in Boro season	i). Number of seedling per hill should be higher under cold weather
ii). Bird attack is severe in Aus season	ii). Cultivation of rice in block is suggested during Aus season
iii). Availability of supplement irrigation is difficult	iii). Enhancement of social concern is essential

Comments on Monitoring Team:

- i. Tillering of Advanced line BU2 is very good than Advanced line BU1(Check BRRIdhan 50)
- ii. Two yield are same (according to CSO Hathazari)
- iii. Days to maturity 110-115 days

Aromatic rice experimentation at RARS Hathazari, Chittagong

Visit-3, Date: 7 to 12 March 2016



Introduction of Quesungual Slash and Mulch Agroforestry System (QSMAS) for Enhancing Crop Yields and Soil Quality in Chittagong Hill Tracts

PI: Dr. Md. Altaf Hossain, Principal Scientific Officer, Soil Resource Development Institute, SRDI, Farmgate, Dhaka.

Implementation Locations: Research Farm, Soil Conservation and Watershed Management Centre (SCWMC), SRDI, Bandarban.

Major Activities:

	Planned Activities	Implementation Status
1.	A questionnaire based survey about Jhum culture in Bandarban hill district.	A questionnaire based survey was carried out in Ruma, Lama, Thanchi, Ruwangchhari, Alikadam, Bandarban Sadar Upazila of Bandarban hill district.
2.	To check the fertility status of experimental plots.	Initial fertility status of experimental plots were determined. Physical analysis was done determine the soil texture.
3.	Statistical analyses of soil fertility and crop yields.	Statistical analyses of soil fertility and crop yields data was calculated under process.
4.	Recording, analysis and interpreting Soil loss and run off data.	Soil loss and run off data has been recorded and these data has been analyzed.

Budgetary Information: i) Total Approved Budget, 2015-16: Tk. 4,00,000/- ii) Fund released (to date): Tk. 3,00,000/- iii) Fund spent (to date): Tk. 3,00,000/-

Constraints & Suggestions

Constraints	Suggestions
a) Unavailability of quality seeds: Due to remote communication farmers have little or no access to modern variety seeds.	Ensure quality seeds.
b) Knowledge gap: Due to remote communication and scarce opportunity to communicate with extension workers they lack knowledge on modern way of crop culture in sloping lands. Usually they dibble (sow) seeds along the slope which encourages soil erosion.	Proper training and motivated the farmers on modern way of crop culture in sloping lands.
c) Unavailability of credit facility: Farmers have little or no access to institutional credit facility.	Ensure institutional credit facility.
d) Rodents/ animal attack: Most of time farmers incur loss due as rodents/ animal attack their Jhum area.	At least 50'00'' around the research area should be cleaned and frequent use of IPM.
e) Soil erosion/ loss of soil fertility: Farmers also responded that they get poor yield due to loss of soil fertility due to top soil loss.	All agricultural practices should be in contour cultivation. Vegetative measures such as hedge row will be

	established in hill slopes.
f) Natural weeds grow more rapidly and local labour rate is high.	To be suggested to operate close intercultural operation.



Collection, conservation, characterization and evaluation of underutilized fruits in Chittagong Hill Tracts

PI: Dr. A. S. M. Harunor Rashid, Principal Scientific Officer, Hill Agricultural Research Station, Raikhali, Rangamati Hill District.

Major Activities

Sl. No.	Planned activities (to be related to fulfill the objectives)	Implementation Progress up to July 2014 from March 2016
1	Survey of different promising minor fruit varieties in the CHT Hill Tracts	We have already surveyed in some part of Rangamati and Bandarban Hill District.
2	Collection of selected germplasm	Sixty seven germplasm of different minor fruits are collected.
3	Nursery management	Nursing of the collected germplasm are going on in the nursery.
4	Management of previously established minor fruits orchard	Management activities of established minor fruits orchard are running in the field.
5	Evaluation of minor fruits	Evaluation of minor fruits like Seedless guava, River ebony, Phalsa, Bael, Wood apple, Dragon fruit, Jamun, star gooseberry, exotic date palm, Sweet caranda, Peach, Star apple, Aonla and Cherry are going on in the research field.
6	Transplantation of newly collected minor fruits	Grafted seedlings of bael, pummelo, santol, plum, peach, mandarin, rokto gola, jhinuk badam and aingchi gola have been transplanted and are in evaluation in the research field.

The present project was designed for three years. The schedule of activities has been designed already. For the first year we partly completed a survey work to find out the promising minor fruit germplasm from hilly area. This survey is done in the Rangamati and Bandarban Hill District during July 2014 to March 2015. Agriculture Extension Officer (AEO), Sub Assistant Agriculture Officer (SAAO) of Department of Agriculture (DAE) and farmers of the respective areas expand their helping hand by giving vital information about quality minor fruits. A good number of germplasm of different minor fruit crops attracted our attention because of its diversity and quality. We already collected some of these germplasm such as pummelo (02), bael (55), santol (02) and mandarin (01) from Kaokhali, Kaptai and sadar upazila of Rangamati Hill District. We also

collected some germplasm like, pummelo (01), mandarin (02), rokto gola (02), from Roma, sadar upazila and remote area of Bandarban Hill District and aingchi gola (02) and jhinuk badam (10) from Teknuf, Cox'bazaar and kalganj, Jessor respectively . The number of germplasm collected is sixty seven (67). The collected genotypes are nourished in our research nursery and transplanted (83 saplings out of 67 germplasm) in the research field and are in evaluation. We have done the management work of the existing germplasm of established minor fruits orchard and it is also going on. Evaluation of seedless guava, phalsa, bael, wood apple, aonla, star gooseberry, star apple, river abony, exotic date palm, peach, cherry and dragon fruit crops are going on in the existing established minor fruits orchard of HARS, Raikhali, Kaptai, Rangamati Hill District.

Collection of minor fruits

We already collected sixty seven (67) germplasm of Pummelo, Bael, Mandarin, Santol, Plu, Peach, Rokto gola, Jhinuk badam and Aingchi gola from different areas of Chittagong, Cox'bazar, Rangamati and Bandarban Hill District and transplanted eighty three (83) saplings of above mentioned genotypes in research field.

Conservation of minor fruits

There are lots of minor fruits are available in Bangladesh that are endangered to be extinction by modern agriculture and globalization. The major fruits cover more than 75% of the area and they cover 84% of the total fruits production. Minor fruits occupy only 5% of the total area under cultivation. Bangladesh, especially Chittagong Hill Tracts, has rich and largely resources of fruit species, the majority of which are unexploited or under exploitation and often available in the local markets. Those fruits are well adapted to the local climate, highly nutritious and contributing in the poverty reduction, household food security of rural peoples. To conserve and adapt the endangered minor fruits we have collected more than sixty germplasm and established a germplasm orchard at the research field of HARS, Raikhali, Rangamati in 2008. At present, most of them are in fruit bearing condition.

Evaluation of minor fruits

To rescue these minor and exotic fruits with huge genetic diversity from evanish, proper genetic resources management strategies is needed.



Fig: Bel

LIVESTOCK

The Livestock Division of BARC is involved in organizing and managing various research and other related activities for developing the livestock sector in

Characterization, floral biology determination and evaluation are very important for conservation and varietal improvement of a crop. Hence evaluation of minor fruits like Aonla, Star gooseberry, River abony, Star apple, Jamun, Seedless guava, Exotic date palm, peach, Cherry and Dragon are going on in the research field of Hill Agricultural Research Station, Raikhali, Kaptai, Rangamati Hill District.

Budgetary Information:

- i) Total Approved Budget, 2015-16 Tk: 4,00,000/-
- ii) Fund released (to date) Tk: 2,00,000/-
- iii) Fund spent (to date) Tk: 158000/- (31 March, 2016)

Constraints & Suggestions:

Constraints	Suggestions
Descriptors of minor fruits are unavailable and available descriptors of minor fruits are in very brief.	Evaluation of established different minor fruits would be done in the research field instead of characterization

Any other Information

Under the research activities of minor fruits already three varieties of minor fruits have been released namely BARI Misti lebu 1, BARI Jolpai 1 and BARI Dragon fruit 1. Seedless guava (pipe line) is waiting for variety registration by National Seed Board (NSB), jamun and natal plum (misti karamcha) are in process for another variety registration in future from this project.

Bangladesh. This division is working to achieve the goal of improving nutritional status of the general mass through cost-effective livestock production for increased supply of animal origin food, supporting increased crop production through providing healthy draft animals and biological manure, and helping the rural poor in the generation of employment, income and fuel supply through profitable livestock rearing.

To carry out the mandated responsibilities of BARC and to full-fill the national need the division is entrusted with the duties of planning, reviewing, prioritizing, approving, monitoring, evaluation, supervision and coordination of the livestock research programs implemented by the relevant NARS institution and other institutions including universities, Department of Livestock Services (DLS) and NGOs. The division is providing training and research support to the NARS institution, DLS, relevant faculties of various educational institutions and NGOs. The

division is imparting policy support to the relevant NARS institutes and extension agencies. The division is arranging, conducting and participating in training, meetings, and seminars/workshops. The division is also engaged to support national avian influenza/bird flu prevention and control programs, to recruit scientists/officers in NARS institutes, to support different research activities of NARS institutes, and to support different activities of National Agricultural Technology Project (NATP)- BARC and DLS Units.

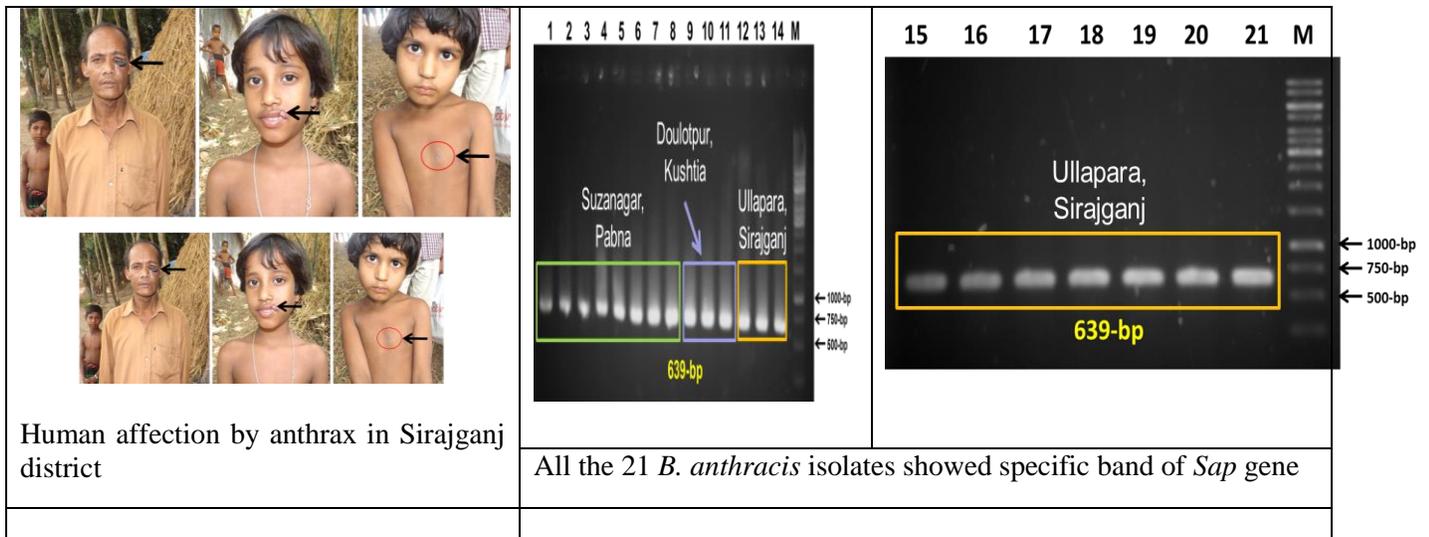
Project Development/Project Financing

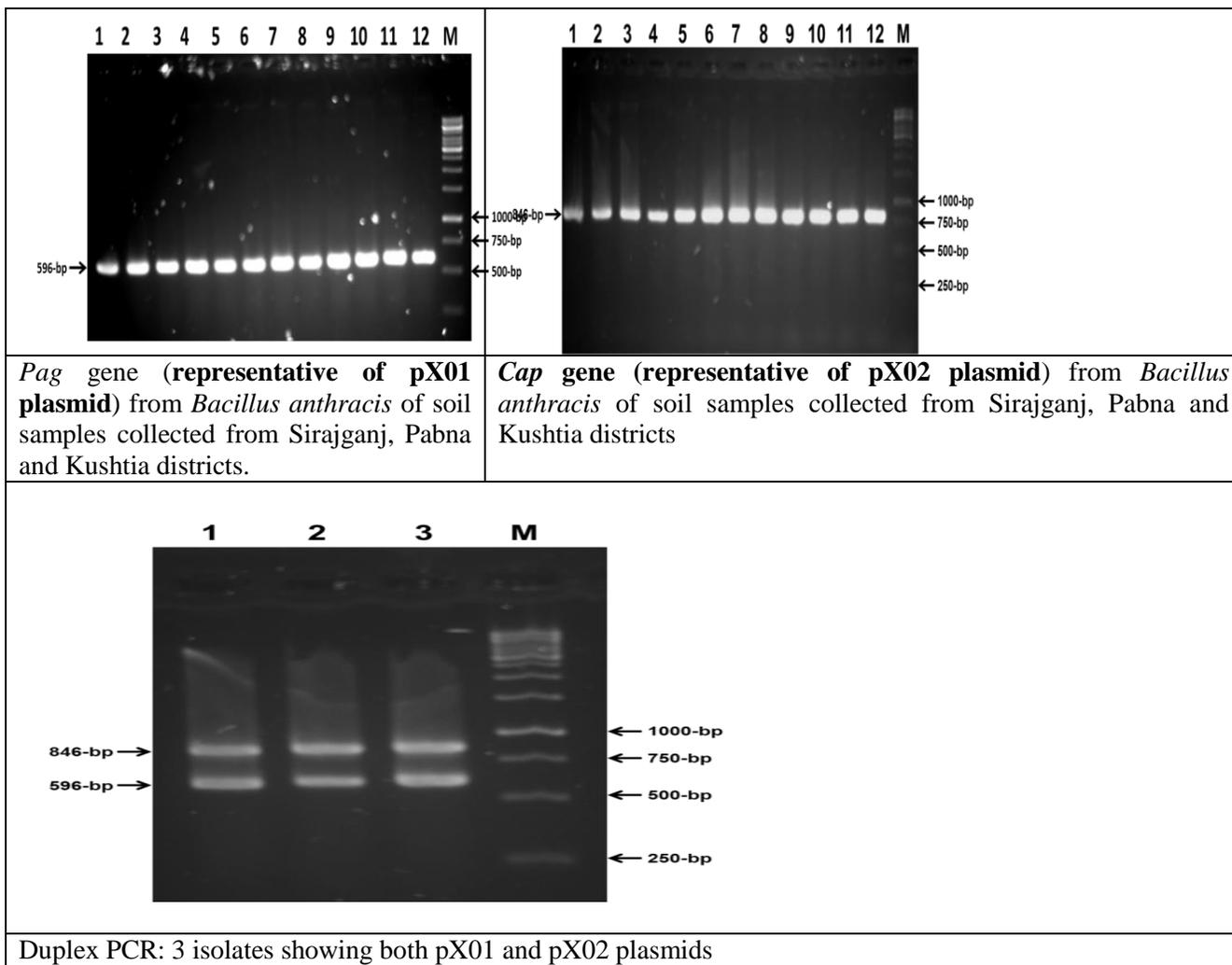
Research projects under funding from Research Grant

There were a total of 2 on-going research projects from Bangladesh Agricultural University (BAU), funded under Research Grant of BARC. These research projects developed with the leadership/co-ordination of Livestock Division, BARC. Livestock Division was directly involved for overall coordination, supervision and regular monitoring of these project activities. Fund release and brief progress of these projects during the year 2015-2016 are given below:

Molecular characterization of *B. anthracis* isolated from the field cases of Bangladesh and selection of vaccine candidates: The research work was aimed at isolation and identification of *Bacillus anthracis* from soils, meat, blood and swab samples. A total of 184 soil, 1 blood, 3 meat and 1 swab samples were

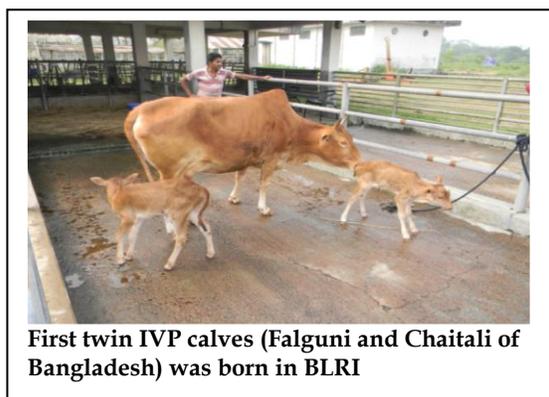
collected from different areas of Bangladesh during anthrax outbreaks during July 2015 to June 2016. The DNA from the soil samples were extracted, and were subjected for molecular detection of *B. anthracis* targeting *Cap* (pX02 plasmid), *Sap* (*B. anthracis* specific) and *Pag* (pX01 plasmid) genes. The bacteria associated with blood, meat and swab samples were isolated and primarily identified as *B. anthracis* through a series of conventional bacteriological and biochemical characteristics, followed by PCR detection targeting *Cap*, *Sap* and *Pag* genes. So far 129 soil samples have been tested for the presence of spores of *B. anthracis*. Among 129 soil samples, the viable *B. anthracis* spores were extracted from 21 (16.3%) samples. All the blood, meat and swab samples were confirmed to be presence of *B. anthracis*. All the 21 soil samples were confirmed for the presence of *Sap* gene of *B. anthracis* showing 639-bp target size in gel electrophoresis. pX01 plasmid (target size 596-bp) were present in 12 isolates and pX02 plasmid (target size 846-bp) were present in other 12 isolates. Both pX01 and pX02 plasmids were harbored in 3 isolates. The vaccine strain (stern F34) was confirmed to be present *Sap* and *Pag* genes. The qualitative study revealed that lack of vaccination and unawareness were the main causes of repeated outbreak of anthrax in Bangladesh. In conclusion, pX01 and pX02 plasmids have been identified in Bangladesh isolate of *B. anthracis*. Effective vaccination program and awareness among people can be implemented for the effective control of anthrax in Bangladesh.





Production of algae to use as environment friendly feed supplements for poultry: Spirulina is microalgae contains higher amount of nutrients including protein, carotenoids and micronutrients and grown in organic or inorganic media. So, considering the facts a number of 144 broiler chicks were reared for a period of 7 days and afterwards birds were divided into six dietary groups (24 birds in each group and 8 birds per cage). Vitamin mineral premix of the feed was replaced by the media dry matter at 0, 25, 50, 75 and 100% considering group 1, 2, 3, 4 and 5. Further group 6 was considered as negative control where both vitamin mineral premix and Spirulina was absent. The feeding was continued subsequent 21 days (28 day old). Final body weight was 999, 985, 977, 953, 933 and 859g/bird in group 1, 2, 3, 4, 5 and 6 where significantly ($p < 0.5$) higher weight observed in positive control as well as group 2, 3 and 4, but was lower in group 5 as well as negative control (group 6). But feed intake observed more or less similar in all the groups (1500g; $p < 0.5$).

Feed conversion ratio (kg FI/kg LWG) observed significantly different like 1.79, 1.80, 1.84, 1.88, 2.04 and 2.08 in group 1, 2, 3, 4, 5 and 6 respectively ($p < 0.5$), where higher in negative control group (6) and 100% replacement group (5). So, vitamin mineral premix would be possible to replace by the Spirulina media up to 75%.



First twin IVP calves (Falguni and Chaitali of Bangladesh) was born in BLRI

Coordination of Core Research Activities of NARS Institutes (BLRI)

The Livestock Division of BARC is responsible for scrutinizing and coordinating the core research programs of Bangladesh Livestock Research Institute (BLRI) and devoted itself performing the following duties:

- Reviewed the annual research programs and suggested improvement avoiding wasteful duplication.
- Provided technical support and guidance based on national policy and demand in planning the institute's research programs.
- Done field level monitoring and evaluation of the core research projects to provide technical support and to suggest further improvement.
- Participated in the review workshops, board of Management meetings, different technical committee meetings, recruitment of scientists and other staffs of the institute.
- Done mid-term evaluation of the on-going research projects.
- Done annual evaluation of the completed research projects.

Research Highlights of NARS

Among the various other agencies and institutes, Bangladesh Livestock Research Institute (BLRI) is the only NARS institute working with the mandate of identifying and solving the basic problems of livestock development through research and demonstration in the country. BLRI conducted a total of 52 research projects/programs during the year 2015-2016. Research highlights of some these projects/programs are given below:

1. Production of calves through transfer of *in vitro* produced cattle embryos at farmers level and BLRI Research Farm: *In vitro* embryo production (IVP)

technology hasten genetic progress in traditional cattle breeding programme through increasing population size of high yielding cows. BLRI is conducting researches on IVP for multiplication, distribution and production of high yielding dairy cows. Hence, protocols for oocyte aspiration, ovarian follicular dynamics, IVP, recipient preparation and embryo transfer were practiced in BLRI. The present research programme was designed to produce calves through transfer of IVP embryos. To achieve the above objective, blastocysts were developed from bovine slaughterhouse ovary derived oocytes and transferred into 5 recipient cows. One cow conceived and delivered two healthy female calves, first times in Bangladesh (called as Falguni and Chaitali) upon a 277-day gestation period. This technology will facilitate dairy development in Bangladesh.

2. Screening and development of different coat color variants goat stock at BLRI: "Black Bengal Goat (BBG)"

, the only goat breed originated in Bangladesh has many coat color patterns like Solid Black, Solid White, Dutch belt, and Toggenburg pattern among others. In depth research is conducting on Solid BBG since last two decades and no research has been conducted on Solid White, Dutch belt, and Toggenburg varieties of BBG. Considering, this fact, BLRI collected Solid White (12 solid white does), Dutch Belt (5 does and 2 bucks), and Toggenburg (6 does and 3 bucks) pattern BBG for characterization, conservation and performance improvement in 2016. Morphometric characteristics of the three goat varieties recorded during this study were summarized in the following Table:

Morphological characteristics of three different Black Bengal goat varieties

Traits (Wt. in Kg, Len. in cm)	Toggenburg		Dutch belt		Solid white
	Doe	Buck	Doe	Buck	Doe
Body weight	24.1±3.72 (6)	16.3±5.17 (3)	22.7±1.53 (5)	17.2±6.85 (2)	26.8±3.83 (12)
Body length	55.8±3.13 (6)	49.7±4.26 (3)	54.4±1.33 (5)	48.5±5.50 (2)	52.3±2.39 (12)
Heart girth	66.3±2.30 (6)	58.0±6.66 (3)	66.6±2.46 (5)	60.5±9.50 (2)	71.4±3.75 (12)
Wither height	55.5±2.57 (6)	50.7±4.98 (3)	54.4±0.93 (05)	51.5±4.50 (2)	53.6±1.60 (12)
Head length	16.1±0.92 (6)	14.8±0.60 (3)	16.6±0.81 (5)	15.3±1.25 (2)	17.8±0.56 (12)
Head breadth	10.1±0.40 (6)	10.7±0.60 (3)	11.3±0.70 (5)	10.5±0.50 (2)	9.9±0.54 (12)
Horn length	8.9±0.76 (6)	9.3±1.75 (3)	10.8±1.15 (5)	8.1±0.90 (2)	11.6±1.39 (12)
Horn diameter	5.1±1.25 (6)	2.9±0.67 (3)	5.1±1.11 (5)	3.3±0.75 (2)	5.0±0.81 (12)
Ear length	16.3±0.92 (6)	12.5±0.73 (3)	15.0±0.26 (5)	14.5±0.50 (2)	15.4±0.75 (12)
Ear breadth	7.1±0.78 (6)	4.7±0.37 (3)	5.5±0.89 (5)	5.8±0.50 (2)	6.9±0.41 (12)

Neck length	18.2±1.28 (6)	13.3±0.88 (3)	18.0±1.89 (5)	14.3±0.75 (2)	20.3±0.78 (12)
Neck diameter	30.2±0.95 (6)	32.0±5.20 (3)	30.7±1.50 (5)	36.0±4.00 (2)	32.1±1.71 (12)
Tail length	11.3±0.49 (6)	11.7±0.82 (3)	12.3±0.85 (5)	10.3±1.25 (2)	11.0±0.51 (12)
Tail breadth	4.2±0.26 (6)	3.8±0.17 (3)	4.8±0.37 (05)	3.4±0.10 (2)	4.5±0.23 (12)
Foreleg length	47.5±1.15 (6)	44.7±2.73 (3)	49.0±2.83 (5)	43.0±2.00 (2)	42.5±2.73 (12)
Hind leg length	49.4±1.02 (6)	46.2±3.09 (3)	52.0±2.78 (5)	46.0±3.00 (2)	44.7±2.77 (12)
Udder length	14.7±2.42 (6)	-	13.0±2.55 (5)	-	16.8±1.01 (11)
Udder breadth	25.0±5.00 (6)	-	23.0±3.78 (5)	-	29.2±2.90 (10)
Teat length	4.5±1.50 (2)	-	3.5±0.42 (5)	-	4.1±0.38 (9)
Teat diameter	4.0±0.00 (2)	-	2.6±0.36 (5)	-	3.2±0.71 (9)
Testicular length	-	8.0±1.53 (3)	-	11.3±1.75 (2)	
Testicular diameter	-	15.4±3.19 (3)	-	19.3±2.25 (2)	

*Figures in the parenthesis indicate the number of observations; No significant differences were found ($p>0.05$) among different goat varieties for the studied traits

3. Vegetable waste as a feed for ruminants: The vegetable wastes of market places are found to be potentials to be processed into feeds of high nutritional values (12.0% to 32.0% CP on dry matter basis and may replace conventional concentrate @30% in animal diets) without having any residual impacts of toxins, heavy metals or pesticides in the processed mesh feed. The average daily vegetable waste at Karwan Bazar, Dhaka during March to June, 2016, found to be about 54.4 (\pm 23.6) tonnes representing about 1.1 % of the total supply. A year round quantification of waste vegetable is important to support cost effective feed production and marketing using the good practices developed so far by the BLRI.

4. Moringa could be a potential protein supplement of animal feed: Moringa (*Moringa oleifera*) may yield annually 30-35 ton feed dry matter per hectare containing average 18.0% CP, 60% rumen degradability, and 1.75 to 2.0:1 of CP to ADF ratio. Moringa feed, produced from the tops of black seed variety following the agronomical practices developed by the BLRI replaced conventionally mixed concentrate of ruminant diets. It was ranked as the top most livestock feed in the country. However, the cost efficiency of on farm Moringa feed production compared to other crops and its value addition system development is important for making it available to farmers.

5. Study on fattening of buffaloes and comparison of their production performances and meat quality with cattle:

Cattle fattening, a popular and profitable animal agricultural enterprise in the country, supports production of beef and livelihood of



Fig: Feed produced from food waste



rural peoples including women. The Buffalo bulls of the southern delta, reared in harsh environment keeping them hungry at all ages, may

Fig: Moringa feed

help increased livestock GDP at least 1.0%, if fattened using the good practices developed by the BLRI. It showed that compared to fattened local cattle of average 312.0 Kg live weight at 24 months of age on average FCR of 6.00, buffalo bulls of the same age may yield an average live weight of 367.0 Kg on 6.32 FCR.

Species, age & their interactions		Parameters					
		Initial LW (Kg)	Final LW (Kg)	ADG (Kg)	FCR	Feed cost (Tk, Kg gain)	
BCB-1 (local cattle)	Age	18M	164.3	244.9	0.77	5.85	118
		24M	230.3	335.8	1.00	5.67	112
		30M	264.7	354.7	0.86	6.46	130

Buffalo (local)	Age	18M	200.7	306.7	1.00	6.43	136
		24M	237.6	350.7	1.08	6.37	131
		30M	314.3	444.3	1.24	6.15	132
Species	BCB-1		219.8	311.8	0.88	6.00	120
	Buffalo		250.9	367.2	1.11	6.32	133
Age	18M		182.5 ^a	275.8 ^a	0.89 ^a	6.14	127
	24M		234.0 ^b	343.2 ^b	1.04 ^b	6.02	122
	30M		289.5 ^c	399.5 ^c	1.05 ^b	6.31	131
SED			7.99	9.25	0.03	0.21	4.07
Sig.lev.	s		**	***	***	*	*
	a		***	***	**	NS	NS
	s×a		NS	NS	*	NS	NS

6. Study on nutrient utilization and biometrical ranking of available roughages in Bangladesh: The Bangladesh Livestock Research Institute (BLRI) developed a biometrical ranking system of available fodder crops considering their efficiencies of biomass yield, response to animal production, reduction of

methane emission in the rumen and cost and benefit ratio. According to the ranking system it was found that German grown on farm liquid wastes was better than Jumbo green and Para.

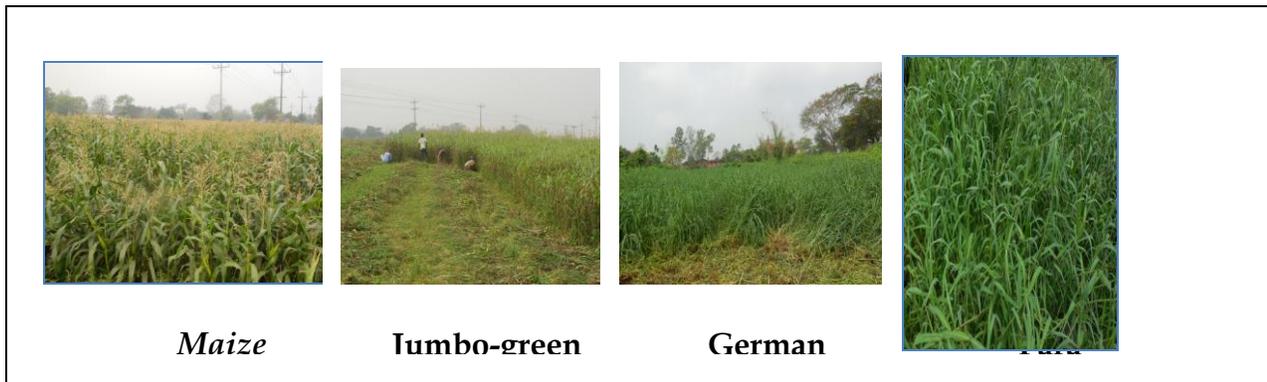


Table : Nutritional and growth responses of different roughages

Parameters	Diets				SED	Sig. level
	Maize	Jumbo-green	Para	German		
DM intake (Kg/d)	2.99 ^a	3.12 ^a	2.43 ^{bc}	2.83 ^{ac}	0.13	*
CP intake (Kg/d)	0.28 ^{ac}	0.31 ^a	0.25 ^c	0.38 ^b	0.01	***
OM intake (Kg/d)	2.80 ^a	2.81 ^a	2.09 ^{bc}	2.35 ^{ac}	0.11	*
DM intake (kg; % LW)	1.91 ^{ac}	1.94 ^a	1.55 ^b	1.70 ^{bc}	0.05	**
DM digestibility	67.25 ^a	53.81 ^b	54.18 ^b	64.23 ^a	1.15	***
CP digestibility	60.24 ^{ac}	43.51 ^b	55.03 ^a	64.14 ^c	1.34	***
OM digestibility	69.84 ^a	57.79 ^{bc}	53.74 ^c	64.48 ^d	1.16	***
DDMI (Kg/d)	2.01 ^{ad}	1.69 ^{bcd}	1.33 ^b	1.82 ^{ac}	0.08	**
DCPI (Kg/d)	0.17 ^a	0.14 ^a	0.14 ^a	0.25 ^b	0.009	***
Initial LW (Kg)	160.9	161.0	162.0	162.1	5.63	NS
Final LW (Kg)	164.8	152.1	154.1	168.5	5.88	NS
Daily gain/loss, g	64.00 ^a	-148.0 ^b	-132.0 ^b	107.0 ^a	0.03	***
FCR	58.42 ^a	-24.52 ^b	-27.87 ^b	46.92 ^a	8.96	***

7. Title: Conservation and improvement of native chicken: Performance of fifth generation:

Study was conducted at Bangladesh Livestock Research Institute, Savar, Dhaka with the objectives to assess the performances

of three Indigenous Chicken genotypes under intensive management. Generation wise annual egg production of indigenous chicken is



Fig: Multi Color Table Chicken (MCTC)

shown in Figure. In initial generation, egg production of Non-descript Deshi was better than Hilly and Naked Neck genotype but in later generation, egg production of NN genotype was better. It is concluded that Hilly genotype may be chosen for meat production and Naked Neck genotype for egg production. For further improvement selection should be continued.

8.



Title: Conservation and improvement of Quail: performance of fifth generation:

Four genotypes of quail like Japanese (J), White (W), Black (Bl) and Brown (Br) quail are being maintained at BLRI with the objective to develop a suitable meat type quail genotype for our existing farming. Significantly higher

body weight was found in White and Brown followed by Black and Japanese quail genotypes at different period of age. Based on the performances, White quail was superior for body weight and Black quail for egg production. These findings give us more attention for continuing the quail breeding research for producing a suitable meat type quail genotype in our country.

9. Development of vitamin mineral premix for commercial meat type chicken with available resources

Highlight: Feed additives are used for growth promotion, improve products quality, reduce environmental pollutants and improve immune response. The developed vitamin mineral premix (VMP) was evaluated through comparing the performance of BLRI developed 378 multi colourtable chicken (MCTC) using VMP in the diets. Significantly reduced feed intake increased WG and lowest FCR were observed compared to control. It was also showed better growth pattern during 8 to 10 weeks of age. The formulated VMP showed suitable and it may be substituted in the diet of meat type chicken up to 10 weeks of age.

10. Title: Conservation and improvement of native duck genotypes: Highlight:

A total of 550 day-old ducklings comprising of two selected native ducks namely Rupali and Nageswari were hatched in one batch to determine performances. Ducklings were brooded in brooder house until 4th weeks of age and then they were reared in floor house under intensive management condition. The ducks and drakes were separated after 10th weeks of age. Age at first laid and onset of egg weight of Rupali duck were found 157 d and 54 g which were comparatively higher than Nageswari duck (152 d and 51 g respectively). Body weight at onset of lay and egg production at 24 to 48th weeks were found significantly different 1662g, 158 numbers and 1467g, 148 numbers in Rupali and Nageswari duck respectively. Highly significant different in egg weight was observed between the genotypes Rupali and Nageswari duck at the age of 30, 36 and 40 weeks. These finding will be helpful for further program formulation to carry on the duck breeding activities at BLRI.



Fig: Rupali Duck



Fig: Nageswari Duck



Fig: Improved Layer

11. Title: Maintenance and improvement of chicken pure lines and performance of BLRI developed layer hybrids: Highlight: A total of 500 day old chicks from each line of 4 lines (WR, RIR, BPR & WLH) were marked individually by wing band. After brooding, males and females was selected at 8 (85 male & 220 female) and 16 (65 male & 200 female) weeks of age based on the uniformity & phenotypic characteristics. Finally, males (17) and females (85) was selected at 38 weeks of age on the basis of selection index (Age at first egg, body weight, Egg production and Egg weight) to produce next generation. Hatching eggs are collecting based on the assortative mating design. Among the performance of purelines WR was the highest among the four lines.

12. Immune escape and genetic evolution of highly pathogenic avian influenza virus H5N1 with the advent of vaccination in poultry in Bangladesh: HPAI H5N1 virus has spread globally and has become endemic in several parts of the world, which is unique for an HPAI strain. Antigenic drift at the epitope regions is among the strategies the influenza virus uses to escape adaptive humoral immunity. We supervised 50 farms vaccinated against HPAI H5N1 in each of three divisions (50 x 3) of the country and samples have collected thrice yearly. Virus isolation has done from the cloacal and tracheal swab samples. We have isolated 52 isolates of type A influenza virus from the vaccinated farms and characterize for subtypes through rRT-PCR. About 35% farms were infected with Avian influenza A virus in which 17% was sub-type H5, 70% was sub-type H9 and 13% was indeterminate. Sequencing is ongoing for analysis the genetic variation and antigenic drift.

13. Prevalence of emerging and re-emerging foodborne pathogens and drug resistant gene in poultry value chain: Foodborne diseases are widespread and becoming a growing public health concern not only for the developing countries but also for the developed nations. Emergence of antimicrobial resistance foodborne bacteria due to easy access & indiscriminate use of antibiotic has become a serious problem in Bangladesh. A total of 63 (26%) *salmonella* along with 97(4%) *E.coli* O157 isolates were recovered from 420 samples taken in 6 categories representing 22 types during 2015-2016. In disk diffusion assay, high rates of antimicrobial resistance were observed for tetracycline (73.8%; 66.8%), gentamicin (72.4%; 69.2%), ampicillin (70.3%; 68.9%), amoxicillin (54.5%; 67.9%) and ciprofloxacin (50.3%; 45.9%) in *salmonella* & *E. coli* O157 respectively (CLSI standard). About 78.2% salmonella and 75.1% *E. coli* O157 isolates showed a multidrug resistance (MDR) phenotype (resistance to ≥ 2 antibiotics).

14. Modulation of antiviral activity against Infectious bursal disease virus through activation of Toll-Like Receptor (TLR) signaling pathway : Host cells use various receptors to detect viral infections by recognizing pathogen-associated molecular patterns (PAMPs) and subsequently induce an antiviral response. Prominent among these are Toll-like receptors (TLRs). Poly ICLC is a synthetic double stranded RNA comprising of polyriboinosinic-poly ribocytidylic acid (Poly IC) stabilized with L-lysine (L) and carboxymethylcellulose (C). Poly ICLC are TLR-3 agonists and are potent inducer of interferons and natural killer cells. Considering these facts the study is under taken with the following objective- determination of cytokine and chemokines activities of Poly ICLC activated TLR3 in chickens that had not been

immunized with IBD vaccine and Determination of efficacy of Poly ICLC activated TLR3 and commercial IBDV vaccine in modulation the innate immune response to IBD. For this study we have collected the Poly ICLC from Oncovir, USA and we are now breeding the semi-SPF chicken from semi-SPF eggs to perform the animal trail.

15. Development of Peste des Petits Ruminants (PPR) free zone in selected areas of Bangladesh to meet global control strategy:

Goat population was determined in 21 selected villages under Jicorgacha upazilza of Jessore district by door to door baseline survey with pre-tested questionnaire. All 1198 sera samples were tested by cELISA. The numbers of goats per household were ranges from 3.50-3.55 (in total 1203 household). In case of Pre-vaccination, overall the seropositive goats were 60.89% in treatment villages where as the control villages were 35%. Sera analysis from 60 days post-vaccinated goat from the treatment 18 villages showed 60 days post-vaccination herd immunity rose to 87.85% whereas in the control villages seropositive goats were 30.06%. After 30 months of post vaccination, the long life immunity level was found in 86% and 94.11% in Modhukali and Misridiara village respectively.

16. Development of biologics for the diagnosis of Peste des Petits Ruminants (PPR)

Sub-title: Development of polyclonal antibody based PPRV detection system: PPR has devastating socio-economic impacts due to heavy production losses resulting from very high mortality (up to 100%) and high morbidity (10-100%). A polyclonal antibody based PPRV detection system has been developed by providing 4 times weekly PPR vaccine inoculation in mice intraperitoneally. Serum was separated from

blood of inoculated mice after 15 days of last vaccination and measured titer by cELISA. Monoclonal antibody (Mab) from commercial cELISA kit (IAEA joint division and BDSL, UK) was used along with polyclonal antibody (Pab) for comparison. In comparison, it is concluded that Pab based PPRV detection system can be used as useful and low cost technique for the diagnosis of PPR outbreak in the field which will be helpful for the control of PPR disease in Bangladesh.

17. Value Chain Analysis of Milk and Comparative Advantage of Milk Production in Bangladesh

The study reveals the production cost of milk for cross-bred cattle was estimated BDT 43,673/ ton. Per ton net return was estimated for cross-bred cattle BDT 2,543. On an average, milkmen added value 29%, sweet seller 150% and tea seller 175%. The private profit per lactation period of fresh milk (raw milk) production is BDT 43094.5 means government policies leads to the profitable milk production in Bangladesh. On the other hand social profit of milk production is BDT 7108.41 per lactation indicates milk production under free trade will be in favour of producers. Output transfer is 32292.89 indicates that government protective policies affect positively to the producer incentives. The input transfer is -638 which is also negative. The negative value illustrates that the domestic producer buy the imported inputs less than the world price for milk production. The factor transfer is -3055.2; the negative value shows the opportunity costs of non-tradable inputs are higher than their market prices. On the other hand the net policy transfers is 35986.08, this positive value means that milk producer could earn less profit without government intervention (Table 1).

Table 1: Policy analysis matrix for fresh milk (cross-bred) per lactation period in Bangladesh

Items	Revenue	Costs		Profit
		Tradable inputs	Domestic factors	
Private prices	103638	23594.5	36949	43094.5
Social prices	71345.1134	24232.5	40004.2	7108.41
Divergences	32292.8866	-638	-3055.2	35986.08

Source: Own estimation

The value of the DRC estimation revealed that Bangladesh had a comparative advantage for import substitution of fresh milk as on DRC values were less than 1 (<1). The SCB in less than one, it indicates the benefit of government policy of protection is the higher

than the cost of protection. Estimated profitability is greater than 1 (>1) indicates that the private profit is higher than the social profit (Table 2).

Table 2: Different indicators of protection and comparative advantage

Items	Unit	Value
NPCO = Nominal Protection co-efficient (subsidies to output)	Ratio	1.45
NPCI = Nominal Protection co-efficient (subsidies to inputs level)	Ratio	0.97
EPC = Effective protection co-efficient	Ratio	1.70
DRC = Domestic Resource Cost	Ratio	0.84
SCB = Social Cost Benefit	Ratio	0.90
PC = Profitability co-efficient	Ratio	1.20

Source: Own estimation.

18. Identification of repeat breeding problems and measures in dairy cows at Baghabari milk shed areas :

As a preliminary work, to identify the possible causes for repeat breeding (RB) problems in Baghabari milk shed areas, a baseline survey was successfully completed in accordance with the objectives of this project. Major causes associated to repeat breeding problems in dairy cows were identified by survey, rectal palpation of RB cows, nutritional analysis of feed and frozen semen quality analysis. Incidence of repeat breeding problems was found about 29 percent in the studied areas. Lack of balanced feed, poor quality semen, incidence of reproductive diseases, un-skilled Artificial Insemination Workers (AIW), mal-treatment of RB cows, crossbred genotype, high yielding cow, improper heat detection at the time of artificial insemination, seasons and lack of deworming were found to be the probable causes of RB problems in the milk pocket areas.

19. Study on Prevalence and Molecular Diagnosis of Subclinical Mastitis in dairy Cows at Baghabari Milk shed area, Sirajganj:

The present research work was undertaken with the objectives to investigate the prevalence of Subclinical Mastitis of cows in milk shed areas and dissemination of Mastitis control package to the dairy farmers. A questionnaire was prepared and pre-tested in the respective field and surveyed with direct interviewed of farmers to collect both herd and animal level data including herd size, no. of parity, age, milk yield, history of diseases specially mastitis, type of breed, deworming, vaccination, hygienic status etc. A total of 1200 milk samples from each quarter of 300 crossbred dairy cows from 60 dairy farmers at thirteen

villages of Shahjadpur upazila of Sirajganj district and Sathia upazila of Pabna district were tested to CMT, WST and SFMS for sub clinical mastitis during September 2015 to May 2016. In this study, overall prevalence of sub clinical mastitis was 51 % by CMT. Strong positive samples were taken to laboratory with ice box for screening tests, culture, culture antibiotic sensitivity test to detect some species. On the basis of data analysis, observations, we have given some preventive measures & early detective easy methods to farmers through a training programme with a booklet as a part of mastitis control package.

20. Identification and documentation of locally adopted available forage:

Utilization of locally grown fodder varieties might help reduction of buffalo production cost. Considering this fact, research was conducted to find out locally adopted potential fodder germplasm in some buffalo concentrated regions of the country and recommend them for extensive cultivation at farmer's level for feeding their animals. During this study, 29 fodder species were identified from different regions and their taxonomical and nutritional characteristics were evaluated. Agronomical practices of some fodder varieties are going on. Among the identified fodders, *Derris trifoliata* (Kailalota), *Aeschynomene indica* (Sola), *Crotalaria juncea* (Hone), *Vignamungo* (Matekalai /Mashkalai), *Lathyrussativus* (Khasarikalai), *Monocoria hastate* (Baranukla), *Enhydrafluctuans* (Helencha) , *Hygrosryzaaristata* (Futka/Janglidhan) are containing about 15% crude protein.

21. Upgrading and validation of Feed Master application:

BLRI scientist developed FeedMaster android application which will guide the farmer for proper ration formulation. FeedMaster android application is a digital consultant that can easily solve the answer of farmers and stakeholder of how to fed, how much to fed, how to cultivate, how much to cultivate, when to cultivate and what will be the cost of feeding of their animals. This application was update to address other important issues related with profitable dairy and beef farming in Bangladesh like year round fodder production planning, housing management and prevention and control of common bovine diseases among others. Efficient use of this software package will encourage the entrepreneurs to invest in livestock sector to achieve optimum profit from this sector.

22. Performance evaluation of Murrah x Local (ML)F₁ crossbred and production of Nili-Ravi x

Local (NRL) F₁ crossbred buffaloes in Bangladesh:

Local buffaloes were inseminating with Murrah and Nili-Ravi semen to produce crossbred buffalo calves. Total 102 Murrah x Local (F₁) crossbred calves were born until June 2016 in the selected regions of the country and Nili-Ravi x Local (F₁) crossbred calves are growing into the mother's womb. To facilitate artificial insemination, estrous synchronization protocols were practiced in buffalo cows during this study (Figure 1). All treated cows of four treatment groups showed heat. The average weight at birth, 1 month, 3 month, 6 month and 12 months age of Murrah x Local crossbred buffaloes were 27.23; 50.89; 84.5, 125.0 and 209.6kg, respectively.

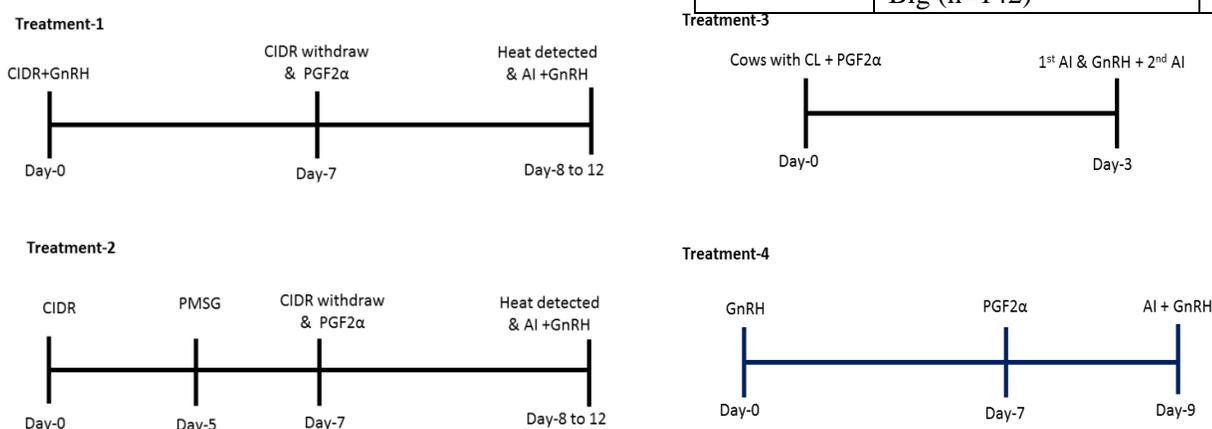


Figure. Estrus synchronization protocols studied in buffalo.

23. Phenotypic and molecular characterization of buffalo genetic resources in selected regions of Bangladesh: Researches were conducted to identify available buffalo breed in Bangladesh. The buffalo populations were grouped based on phenotypic characteristics like coat color, horn pattern, white marking, head shape and body size. Data were collected on individual buffalo and categorized into four grouped as shown in Table 1. Preliminary results showed that, observed buffaloes were belonged to four genetic groups including i) Indigenous type (32%), ii) Murrah cross (27%), iii) Nili Ravi cross within river type buffalo (18%) and iv) Swamp type (23%). Research activities are continuing for molecular characterization of the four buffalo groups.

Table 1. Phenotypic characteristics of Buffaloes

Parameter	Percentage	
Coat Color	Jet Black (n=37)	10.42
	Black (n=202)	56.90
	Grey- Black (n=73)	20.56

Horn Pattern	Light Gray (n=41)	11.55
	Whitish (n=2)	0.56
	Crescent Shape (n=9)	2.53
	Sickle shape (n=11)	3.09
	"C" Shape (n=181)	50.98
	Back upward front (n=50)	14.08
	Short spiral (n=80)	22.53
White Marking	Front downward (n=3)	0.84
	Head (n=17)	4.78
	Tail (n=135)	38.02
	Hock area (n=49)	13.80
Head Shape	Dewlap (n=21)	5.91
	Thin long (n=118)	33.23
	Big (n=142)	40

Body Size	Head Shape	Short (n=93)	26.19
	Massive (n=49)	Medium (n=233)	65.63
		Small (n=69)	19.43

n: number of observations

24. Study on the adaptability of HYV fodder cultivars in drought prone Barind areas of Bangladesh: Drought is one of the main problems because it causes major losses of agricultural crops as well as scarcity of livestock feeds and fodder. Therefore, the study was conducted to adopt BLRI developed high yielding fodders in two drought Barind regions namely, Chapainawabgonj Sadar and Nachol upazillas. The results so far obtained revealed that all cultivars are likely to be adapted in drought prone barind areas in Bangladesh. But, in term of overall production performance, BLRI Napier-2 and 3 cultivars are best suited in those areas.

Table 1. Performance of different Napier cultivars

Parameters	Mean(\pm SEM) of different type of Napier cultivars					Sig. level
	Napier-1	Napier-2	Napier-3	Napier-4	Dwarf	
Biomass yield (ton/ha)	56.2 ^c \pm 0.16	86.2 ^a \pm 0.16	85.0 ^a \pm 0.16	78.5 ^b \pm 0.16	53.3 ^d \pm 0.16	**
No. of tiller/hill	16.18 ^c \pm 1.16	21.21 ^a \pm 1.64	13.44 ^d \pm 1.64	15.98 ^b \pm 1.64	11.88 \pm 1.64	**
Plant height (inch)	34.92 ^d \pm 2.79	39.03 ^c \pm 2.79	46.07 ^a \pm 2.79	43.08 ^b \pm 2.79	34.64 ^d \pm 2.79	*
No. of hill/plot	138.63 \pm 21.60	162 \pm 21.60	188 \pm 21.60	173.94 \pm 21.60	184.17 \pm 21.60	NS
Stem weight (g)	189 ^a \pm 18.78	172.80 ^b \pm 18.78	175.03 ^b \pm 18.78	163.65 ^c \pm 18.78	141.03 ^d \pm 18.78	***
Sheath weight (g)	121.73 ^c \pm 22.91	151.42 ^a \pm 22.91	107.11 ^d \pm 22.91	102.96 ^e \pm 22.91	128.03 ^b \pm 22.91	*
Stem:leaf	1.22 \pm 0.14	1.15 \pm 0.14	1.47 \pm 0.14	1.25 \pm 0.14	1.26 \pm 0.14	NS

Means with uncommon superscript within the same row differed significantly (p<0.05); *-p<0.05; **-p<0.01; ***-p<0.001; NS- p>0.05

25. Developing the fodder production model in coastal and river basin regions of Bangladesh: Due to variable geo-climatic zones, all high yielding fodders are not suitable for all areas. For example, production of HYV fodder is very limited due to soil salinity and sandy soil in nature. So, an appropriate fodder production system in coastal and river basin regions is a crying need for sustainable ruminant production. To

develop fodder production models in coastal and river basin areas of Bangladesh, BLRI-Napier 3 fodder cuttings were distributed among selected farmers and *Matikalai* (*Vigna unguilata*) was supplemented as an intercropping approach. The results as illustrated in Table 1 clearly indicate that cultivation and feeding of high yielding fodders increase milk production which in turns more profitability to the rural farmers.

Table 1. Feeding effect of Napier-3 fodder on milk production of cows.

Cow No 1 (Crossbred)			Cow No 2 (Indigenous)			
Week of milk yield	Daily milk yield (kg)		Sig. difference	Daily milk yield (kg)		Sig. difference
	Existing feeding	Feeding Napier-3		Existing feeding	Feeding Napier-3	
1	9.50 \pm 0.15 (07)	10.32 \pm 0.09 (07)	***	4.00 \pm 0.18 (07)	5.07 \pm 0.05 (07)	***
2	8.75 \pm 0.13 (08)	11.00 \pm 0.16 (08)	***	4.13 \pm 0.20 (08)	5.41 \pm 0.10 (08)	***
Overall	9.10 \pm 0.14 (15)	10.68 \pm 0.13 (15)	***	4.07 \pm 0.13 (15)	5.25 \pm 0.07 (15)	***

*Figures in the parenthesis indicate sample size, ***-P<0.001



Napier-3 and Matikalai
Feeding to Dairy cow

26. Development of existing feed resources based feeding system in haor areas to increase milk production of smallholder dairy farmers: “Haor” is

water-logging wetlands in where cattle are an inseparable and integrated part of small holder subsistence farmers in Bangladesh. No doubt that there is an acute shortage of feed and fodder for ruminants throughout the years. Thus, this study was carried out in haor basin to develop existing feed resources based feeding system. Five farmers (4 adapted and 1 non-adapted as control having at least 1-2 dairy cows for each farmer) were selected in Burishtal village in Sunamganj Sadar. A 45 days trial by feeding HYV fodder and *Chaila* hay (locally most available grass) supplementing with minimum home-made concentrates (rice bran, mustard oil cake and boiled broken rice) was conducted. The results are illustrated in Table 1 which indicates that farmers in haor areas may easily increase milk production by supplying hays prepared from locally available green grasses and producing high

yielding fodder in their fallow land with supplementing some concentrate feeds.

Table 1. Comparison of feed intake and milk yield between control and experimental animals

Parameter	Groups of milking cows		Level of significance
	Control	Treatment	
Straw/hay intake in a day (kg)	3.48±0.15	3.50±0.02	NS
Local/cultivated grass intake in a day (kg)	16.22 ^b ±0.67	19.23 ^a ±0.03	***
Concentrate intake in a day (kg)	0.00	1.7±0.00	-
% straw intake on body weight	2.32 ^b ±0.09	2.09 ^b ±0.01	**
% green grass intake on body weight	10.82±0.45	11.49±0.07	NS
% concentrate intake on body weight	0.00	1.01±0.01	-
Milk yield (litre/day)	1.00 ^b ±0.05	2.56 ^a ±0.03	***

Means with uncommon superscript within same row differ significantly; **-p<0.01; ***-p<0.001; NS-p>0.05

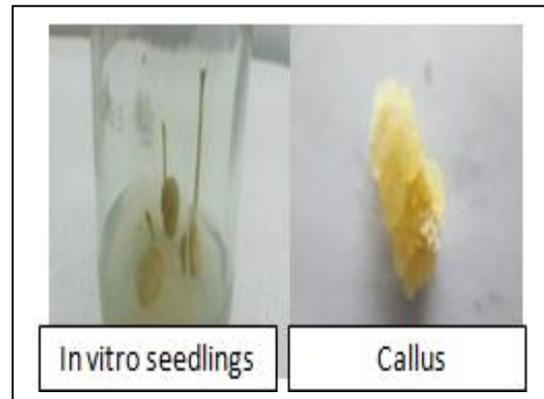
27. Study of Moringa plant fodder agronomy and its feeding to ruminants:

Moringa (Moringa oleifera), a plant fodder being researched and found responsive to increase production and productivity of ruminants. This research was undertaken to determine feeding impacts on dairy cattle, to identify suitable cultivar(s) for year round production and to test on farm production performance of selected *Moringa* cultivars. A feeding trial of 60 days shows that the average daily milk production (kg) and daily weight gain (g) of cows increased linearly ($r^2 = 1$, $p < 0.01$, Fig1) with the increase of *Moringa* feed in the concentrate mixture. *Moringa* feed decreased blood cholesterol from 204.5 mg/dl in the control to 111.5 mg/dl in cows fed concentrate of 100% *Moringa* feed without showing any significant ($p > 0.05$) change in fat, SNF, Lactose or CP content of milk. Thus, *Moringa* may be cultivated as a fodder crop and it increased both daily gain and milk production of cows. Heat Index above 23°F, rainfall at a range of 130 to 330 mm may be suitable for *Moringa* production.

28. Taxonomical and molecular characterization and micro-propagation of selected Moringa cultivars using tissue culture:

Moringa Oleifera, a tropical plant yields biomass of high nutritional value, may be used as an alternative feed for farm animals to

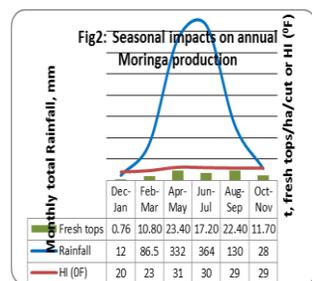
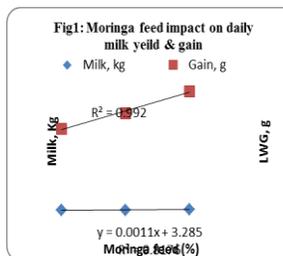
meet up huge deficit of fodder in our country. Out of 13 species globally available, BLRI conserves four *Moringa* cultivars of different origins those are not identified taxonomically and or genetically yet. Thus, the



present research work was undertaken with a view to identification of *Moringa* cultivars through taxonomical and molecular characterization and development of a simple technique for its mass propagation. Most of the qualitative and quantitative characters of four (4) *Moringa* cultivars were found continuous during the taxonomic characterization. The analysis of four (4) *Moringa* cultivars with ten (10) different ISSR primers in this study identified a total 75 fragments of which 65 were found polymorphic (86.67%) and 25 were monomorphic (13.33%). Based on the band pattern and the pair-wise comparisons of genetic distance values ranged from 14.0 to 32.0, it may be concluded that all of the four cultivars belong to *Moringa oleifera* based on the extent of variation.

29. In vitro regeneration of Napier grass for genetic transformation and identification of gene & local gene sources as donors for salt tolerant trait:

In Bangladesh, more than 30% cultivable lands are occupied in coastal regions where farmers are



extremely challenged with salinity for production of HYV fodders. Thus, this research was conducted for *in vitro* plant regeneration, isolation and identification of salt tolerant gene and to develop transgenic fodder which is tolerant to a certain level of salinity for growing in coastal areas of Bangladesh. Ten potential target genes were selected. The total mRNA was extracted and cDNA synthesis using a commercial kit. Ten set primers (JcERF011, OsSaIT, TaSc, TaNIP, OsHKT2, AtNHX1, NnGP, PvUGE1, PvMET1 and LcSAIN1) were designed for screening of target gene. Figure 1 and 2 represents the detection of 1034 and 222 bp cDNA from local Beju or Baksha grass (*Paspalum vaginatum*) (described in Table 1) collected from Khulna, Satkhira and Cox'sbazar areas and samples amplified by primer set *PvUGE1* and *PvMET1*, respectively. In the figure it is clear that primer set *PvUGE1* amplified two samples except Cox's bazar samples. On the other hand primer set *PvMET1* amplified all three samples.

Identification of local gene source grass as donor for salt tolerant trait

Parameter	Description
Local Name	Beju or Baksha
English Name	Water-couch Grass
Scientific Name	<i>Paspalum vaginatum</i>
Chromosome	2n = 20, 40 (Fedorow, 1969)
Habitat	Tidal saline mud flats, beaches, and river banks near the coast, at low altitude.
Distribution	Tropical and subtropical sea coasts throughout the world. In Bangladesh, the southern parts of the country.
Economical uses/values	It is a good fodder grass and a most efficient sand-binder (Bor, 1960).
Propagation	By seeds and rooted tillers.

30. Project title: Development of effective lamb production system in Bangladesh Subtitle: Evaluation of lamb production potentiality of the Barind, Jamuna river basin and Coastal region sheep of Bangladesh under intensive management: The DMI was significantly ($P < 0.01$) lower in Jamuna river basin group compare to other groups. DM, OM

Annual Cost & Returns of Community Farmers in Study Area

Particulars	Study area		Average
	Adarshogram	Tulatuli	
a) Income Source			
Crop farming	17662.37	50565.66	34114.02
Fishery	-	959.59	-
Livestock	11735.24	20341.41	16038.33
Service	45782.17	38488.88	42135.53
Business	28304.95	33535.35	30920.15
Labor selling	52285.14	37000.00	44642.57
Rickshaw/van pulling	14613.86	23848.48	19231.17
Farm income	29397.62	71866.66	50632.15
Non-farm income	140986.14	132872.73	136929.44
b) Gross income	170383.74	204739.37	187561.56
c) Total cost	146518.51	186819.90	166669.21
d) Net Income	23865.23	17919.47	20892.35

and CP digestibility% and nitrogen balance (NB, g/kgmwt/d) were significantly ($P < 0.01$) higher in Jamuna river basin group. Lower FCR was also found in Jamuna river basin group but not differ significantly with Coastal group. Nevertheless, daily gain and total live weight gain (LWG) were significantly ($P < 0.01$) higher in Coastal sheep. However, cost per kg gain not differs significantly among the groups. Besides that dressing percent and nutritive composition of meat does not differ among the groups. The result revealed that Jamuna river basin and Coastal both could be the suitable native sheep for the lamb production in Bangladesh.

31. Project title: Development of herbal anthelmintic for the control of internal parasites of sheep: Subtitle: *In vivo* evaluation of anthelmintic properties of certain medicinal plants against internal parasites-GI nematodes of sheep: It was found from a research carried out on 105 sheep having gastrointestinal nematodes egg per gram (EPG) of faeces ranging from 550 to 7000 that hill glory bower (*Clerodendrum viscosum*) leaves juice was more effective than mahogany (*Swietenia mahagoni*), papaya (*Carica papaya*) and night-flowering jasmine (*Nyctanthes arbor-tristis*) leaves juices (50gm blended in 300ml of clean drinking water in each case) to significantly reduce the EPG counts on day 7 and day 14 after treatment when used orally once @ 10ml/kg body weight, 15ml/kg body weight and 20ml/kg body weight. So, hill glory bower leaves juice prepared may

be used @ 10ml/kg body weight, 15ml/kg body weight and 20ml/kg body weight orally as anthelmintic in sheep population against the internal parasites-GI nematodes.

32. Project title: Development of blended yarns and fabrics from jute, cotton and native sheep wool:

Shawl was produced with the production cost of Tk. 244 (7ft×3ft), suiting fabrics (pant piece, blazer piece etc.) was produced with the production cost of Tk. 588 (per 1 meter) and comfortable blanket was produced from 50:50 ratio of wool-jute yarn with the production cost of Tk. 495 (6ft×8ft).

33. Evaluation of genetic potentials of BLRI developed indigenous chicken varieties under farmers' condition:

BLRI conducted decade long breeding experiment on indigenous chicken varieties (Common deshi, Hilly and Naked Neck) under intensive management condition and their productivity has remarkably increased. To evaluate growth and laying performances of BLRI improved indigenous chicken varieties in farmers' condition, a total of 216 birds of BLRI improved varieties and 72 birds of existing indigenous chicken variety were distributed among the 36 farmers (2 males and 6 females) in 3 locations (Nakla, sherpur; Dinajpur Sadar and Dumuria, Khulna) of Bangladesh. The 12 weeks growth performance results revealed that BLRI improved indigenous chicken varieties seems to be promising in comparison to the existing indigenous chicken. The study will be continued to assess one year laying performances.

34. Study on nutrient requirement and management guideline for BLRI improved hilly chicken:

Study 1: Effect of dietary energy and protein levels on growth and productivity of straight run Hilly chicken up to eight weeks of age

The experiment was under taken to determine the effect of varying energy and protein levels on growth and productivity of hilly chicks at starting period. Final body weight and body weight gain were not significantly affected by the dietary regimes and its interaction. Birds consumed least amount of feed on the diet containing 2850 kcal/kg energy and convert feed comparatively with better efficiency. However, protein efficiency was better at the lower level of dietary protein and energy. Maximum weight gain was achieved at an ME: CP ratio of 142.5 which corresponded with the 2800 kcal/kg ME and 20% CP

diet. Birds fed with 2850 kcal/kg energy diet had higher carcass weight compared to other energy level. Fed on the diets with the lower energy level yielded the heaviest breast meat and thigh meat. Higher carcass weight and heavy breast meat yield at lower ME level of 2850 kcal/kg ME, as obtained in the experiment indicates that firm muscle formation characteristics of hilly chicken may not require excess metabolizable energy.

35. Livelihood Improvement of Rural Farmers through Suitable Livestock and Poultry Technology Dissemination in Selected Hilly Areas of Bangladesh:

Higher adoption of technologies ensures increased food and nutrition security and improve total livelihood of the farmers. To implement this project baselines survey, farmers training programme and some input supply were completed according to project proposal. From the mentioned table we can found over all scenario of the study area. Table also shows that contribution of crop farming (Tk.34114.02) and labor selling (Tk.44642.57) was the highest to their farm income and non-farm income respectively among the others income source. It was revealed that on an average non-farm income (Tk.136929.44) higher than farm income (Tk.50632.15) in study area. The gross income per farm per year was higher (Tk. 204739.37) in Tulatuli than Adarshogam (Tk. 170383.74) but net income was occurred in opposition position. So, The Benefit Cost Ratio (BCR) was higher (1.16) in Adarshogam than Tulatuli (1.10). The surveyed result indicated that production performance of livestock species were very poor due to inadequate feed and fodder along with poor genetic make-up and incidence of diseases.

36. Project: Evaluation of performances of Boer and Jamunapari goat at BLRI:

Bangladesh Livestock Research Institute was under taken this project with the objectives of evaluation of the productive and reproductive performances of Boer and Jamunapari goat and the adaptability of Boer goat at hot and humid climatic conditions. The Birth weight, growth rate, weaning weight and post kidding weight of Boer goat were 3.36±0.07 kg, 0.156±0.02 kg 13.78±1.31 kg and 46.02±1.97 kg respectively. On the other hand, the Birth weight, growth rate, weaning weight and post kidding weight of Jamunapari goat were 1.73±0.07 kg, 0.064±0.01 kg, 9.59±0.49 kg and 31.61±1.08, kg respectively. Weight at maturity of Boer goat (24.42±1.22) was higher than Jamunapari goat (18.52±0.99). The litter size of Jamunapari goat (1.93±0.12) was higher than Boer goat (1.55±0.07).

37. Project name: Improvement of Black Bengal Goat through community breeding: The research was conducted at three villages namely Pachpai, Borochala and Gangatia under Bhaluka Upazilla, Mymensingh district. Fourteen (14) farmers were selected randomly on the basis of elaborate questionnaire who had at least 4-5 years Black Bengal goats rearing experiences to form goat rearing community in the project site area. Two maiden doe (s) from Goat Research farm, BLRI were given to 10 selected farmers and 6 superiors bucks were also given to the 4 buck rearing farmers. A well organized recording card was given for recording of each of the goat in each farmer's house in the goat rearing community. Routine vaccination and de-worming were practiced.

RESEARCH SUPPORT

A. Review of project proposals for operational fund:

- (1) Research project proposals of BLRI were reviewed on 28 October, 2015.
- (2) As an Expert Reviewer of BAS-USDA project, reviewed two project proposals (on livestock, LS-02 and LS-03) and comments were given to BAS on 02 May, 2016.

B. Coordination and Review meeting/workshop:

- (1) As a member of Technical Committee and Expert Committee of BLRI, attended the committee meetings in August 2014 to review the progresses of on-going research projects and to evaluate & approve new project proposals of BLRI.
- (2) As a member of Technical Committee and Expert Committee of BLRI, attended the committee meetings on 28 October, 2015 to review the progresses of on-going research projects of BLRI.
- (3) In BARC, one review workshop was completed on 09 June 2016.

C. Monthly/Quarterly/Half-yearly/Annual progress report/Project completion report evaluation:

- (1) Annual progress report of two Research Grant Projects under Livestock Division were evaluated and comments were given to P&E Division (August-October, 2015).

- (2) PCR of one RG project shown in 2 (C) was not given, and as such no evaluation was done.
- (3) As an Expert Evaluator of the 2nd Annual Progress Reports for CGP projects (KGF BKGET 1st Call), evaluated one on-going research project (on Livestock, TF 12-L) and comments were given to KGF on 03 December, 2015. Comments were also given on this progress report when presented in a workshop organized by KGF on 12-11-2015.
- (4) As an Expert Reviewer of BAS-USDA project, reviewed the Six-Monthly Progress Report of one on-going research project (on livestock, LS02) and comments were given to BAS on 12 November, 2015.
- (5) Expert reviewing was done and comments were given (on 25-8-2015) for a CDMP II project (on Livestock) of the Department of Disaster Management under the Ministry of Disaster Management and Relief.

Support To Avian Influenza/Bird Flue Prevention And Control Programs

As a member of the National Avian Influenza Technical Committee, suggestions and technical support was given throughout the year to prevent and control avian influenza (Bird flue).

Support To Scientists/Officers Recruitment And Research Of BLRI

- As a member of recruitment committee, support was given to recruit best scientist/officer and other staffs of BLRI throughout the year.
- As a member of Technical Committee, support was given to evaluate the progresses of different approved research projects and to evaluate & approve new project proposals of BLRI on 28 October, 2015.
- Support was also given to other activities of BLRI.

Support To Policy Making Programs Related To Livestock

- As a member of the expert committee, support was given directly in policy making programs related to livestock in MOFL, DLS, BLRI and other organizations throughout the year.
- Recommendations were prepared to strengthen prevention and control measures against avian influenza in Bangladesh through organizing a workshop on 09 June, 2016.

Technologies Developed

- Multiplex-PCR for rapid detection of *Bacillus anthracis* spores present in soils (From 1 Research Grant project).

Routine Functions

The division performed several other routine activities that included the followings:

- Annual progress evaluation of the research projects: Done in August to October, 2015;
- Preparation of annual report 2014-15: Done in October 2015;
- Preparation of annual work plan 2015-16: Done in July 2015;
- Preparation of various other documents, etc.: Done throughout the year;
- Review of different documents and preparation of comments on them:
 - “**Animal Welfare Act-2015 (Draft)**” and “**Pet Birds Management Regulation-2015 (Draft)**” of the Ministry of Environment and Forest (MOEF), were reviewed and Comments were prepared on these draft act and regulation and sent to Ministry of Agriculture on September, 2015 (on 14-9-2015 and 21-9-2015).
 - “**Baseline Study Report (Draft)**” of Bangladesh Delta Plan 2100 Formulation Project- Livestock of the General Economics Division (GED), Planning Commission, under Ministry of Planning, was reviewed and comments were prepared and sent to GED on 17-9-2015.
 - Bangladesh Agriculture Research Institute Act-2013 (Draft) was reviewed and comments were prepared and given to DG, BARI.
- Dissemination of technical knowledge as a resource speaker in seminars and training programs organized by BARC/BLRI/DLS/MOFL/KGF/BAS/SAC, etc. and rendering technical support to various organizations and agencies as an expert member and resource person:
- Providing technical support to other divisions of BARC: Done throughout the year;
- Providing technical support to different national and international organizations like BAU, CVASU, SAC, BAS, KGF, FAO, ILRI, etc.:

-Done throughout the year.

-Technical support was given as a member of National Steering Committee (NSC) of the BAU part of the UNEP-GEF-ILRI Asia Project on “Development and Application of Decision Support Tools to Conserve and Sustainably Use Genetic Diversity in Indigenous Livestock and Wild Relatives” to operate the project activities in Bangladesh. NSC meeting was attended on 11 August, 2015 and technical inputs were given.

-As an Expert, one KGF and three BAS (one on-going and two project proposals) research projects were reviewed.

- Monitoring and evaluation of the various projects:

-Two Research Grant projects under livestock were monitored during March 23-25, 2016.

-Seven Research Grant projects of other divisions (Crops-6, Fisheries-1) were also monitored at the same time.

- Participating different workshops/seminars/conference/meetings/trainings in BARC and elsewhere and provided technical inputs:
- Citizen Charter of Livestock Division was prepared and given to the Authority on 21 October, 2015.
- Attended ‘World Food Day’ programs (16 October, 2015); National Vegetable Fare 2016 and Vegetable Demonstration (17-19 January, 2016); Honey Fare 2016 (28 February-1 March, 2016); World Veterinary Day 2016 (30 April, 2016); ‘World Milk Day’ programs (01 June, 2016); National Fruit Tree Plantation Fortnight, 16-30 June, 2016 and National Fruit Demonstration (16-18 June, 2016).
- Citizen Charter of Livestock Division was prepared and given to the Authority on 21 October, 2015.

NATURAL RESOURCES MANAGEMENT

Forestry, NRM

Development/Financing Research Projects

Capacity Development for Agricultural Innovation Systems (CDAIS) project funded by FAO. Inception workshop was done and project work is continued. MoU between BARC and ICRAF (Process continued)

UNEP Consortium "Climate Technology Centre and Network (CTCN)" (Project submitted)

Evaluation of Research Projects of NARS Institutes

Evaluated project proposal entitled *Farm Machinery Technology Development for Profitable Crop Production* by DG, BARI and project entitled *Strengthening Mechanized Rice Cultivation Through Developing Appropriate Machinery* by DG, BRRI.

Project Implementation

Organized CDAIS Inception Workshop funded by FAO. Organized Technical Advisory Group (TAG) Consultation meeting of CDIAS project, funded FAO, Chaired by EC, and BARC on 5 May, 2016. Organized Steering Committee Meeting of CDAIS project at MoA, Chaired by Secretary, MoA, on 8 June, 2016.

Policy Level Contribution

Furnished Comments on the following aspects/ issues and send to the MOA:

1. The Forest Act. 1927 (Amendment 2015)
2. Policy of Forest Retainer Notification, 2015
3. Fifth National Report to the Conservation on Biological Diversity
4. Background Paper for BDF 2015
5. Bangladesh National Action Program for Combating Desertification
6. Land Degradation and Drought, 2015-2024
7. Country Investment Plan (CIP) for Environment, Forestry and Climate Change (EFCC),
8. Cloth Law, 2016
9. Sendai Framework for Disaster Risk Reduction 2015-2030
10. Country Disaster Risk Management Status Report
11. Forest Animal Law, 2012: Reserved Area policy, 2015
12. National Salt Policy 2016
13. Hill Tract Development Report
14. Inputs on Implementation of Second Cycle Universal Periodic Review (UPR) Recommendations
15. Paris Agreement (Paris Climate Summit), 2015

Participated in the policy level meeting as the focal Point/Member in the following meeting:

- Advisory committee meeting and in the expert committee meeting of Research program of Bangladesh Forest research institute(BFRI)
- National Disaster Management advisory committee(DoDM)
- Technical committee meeting of BSTI
- Technical committee meeting of MoEF
- Department of Environment (DoE).
- Department of Forest (DoF).
- Syllabus Committee Meeting of IFESCU, SAU and PSTU of Agroforestry

Research Management/Financial Management and Coordination

Review of Forestry Research Program of BFRI

Reviewed research program of Bangladesh Forest Research Institute and other organizations involved in forestry research and development have been reviewed and necessary guidelines have been provided. It was observed that BFRI took about 75 research programs, BFRI was suggested to undertake research program in future to cater to the needs of the end-users. Similarly, forestry activities of IFESCU and Khulna University were reviewed and a national program was developed.

Research Review 2015-2016 and Program Planning Workshop 2016-2017 of Forestry and Agroforestry Research Activities in Different NARS Institutes and Universities

A three days workshop on "Research Review 2015-2016 and Program Planning Workshop 2016-2017 of Forestry and Agroforestry Research Activities in Different NARS Institutes and Universities" was organized during 24-26 May 2016 at BARC conference room-1. The objectives of the workshop were to review the forestry research activities of 2015-2016, identify the problems, prospects, research activities and development of forestry in Bangladesh and future forestry research planning for 2016-2017 in Bangladesh. Seventy participants of NARS institute, different universities, Department of Agricultural Extension, Department of Forest and other organizations were participated in the workshop. Dr. Abul Kalam Azad, Executive Chairman, BARC was Chief Guest in the inaugural session. Mr. Md. Younus Ali, Chief Conservator of Forest, Forest Department was Special Guest and Dr. Sultan Ahmmed, Member-Director (NRM), BARC, presided over the session as

Chairperson. Thirty one research papers were presented in the workshop.

Monitoring, Reviewing and Evaluation of programs of NARS institutes

Monitoring and evaluation of ongoing research activities of Bangladesh Forest Research Institute are regularly carried out by the Forestry unit, BARC. Dr. Mohammad Shahjahan, CSO (Forestry) visited BFRI on 6 June 2016 for forestry review workshop. Forestry and agroforestry activities at Chittagong University, BFRI Chittagong, BAU, Mymensingh, BSMRAU. Monitored BARC Research Grand funded project in Rangpur and Dinajpur region during 7-10 February, 2016.

Others activities

Attended policy level meeting as the focal Point/Member and worked as member in the different committees of BARC. Participated in the workshops and training organized by BARC and also participated in the consultation workshop with AFACI-Korea delegates. Prepared various report for annual report, newsletter etc.

Agricultural Engineering, NRM

Different policy oriented comments were prepared for appropriate steps on emerging problems and prospective issues in the field of Agricultural Engineering and other related fields. All comments were submitted to the Ministry of Agriculture as per their request through EC, BARC. Some of the activities are given below:

1. Comments on Water Saving Technology (AWD) for Boro rice cultivation.
2. Comments on 'Agricultural Machineries Distribution and Maintenance Directives. under the Bangladesh Southwest Agriculture Support Service Project, implemented by DAE and LGED.
3. Progress report on the implementation of directives given by Honourable Prime Minister during her visit to Ministry of Industry 24 August 2014.
4. Comments on Integrated Small Scale Irrigation Act 2016.

5. Usable information and data was given on energy use and its impact on agricultural sector.
6. Following the Honorable Prime Minister's directives comments has been given on establishment of food industries.
7. Information has been provided on electricity transmitted from solar power to irrigation equipments.
8. Comments on proposed India Bangladesh Agreement of Bilateral Cooperation on Peaceful Use of Nuclear Energy.
9. Provide input in preparing situation paper for the 5th Ministerial Meeting on Industries.
10. Comments on Bangladesh Industrial Act 2016.

Preparation of Mechanization Roadmap

As per letter of Ministry of Agriculture, members of committee and sub-committee worked and conducted series of meeting to prepare a Mechanization Roadmap. Ministry of Agriculture formed a Mechanization Roadmap committee. Executive Chairman, BARC as Convener and Director General of BARI, BRRI, BJRI, BSRI, Director General of DAE and Professor of Bangladesh Agricultural University as member of the committee. Executive Chairman, BARC formed sub-committee. Dr. Sultan Ahmmmed, Member Director (NRM), BARC as Convener and Professor Dr. Md. Monjurul Alam, BAU; Dr. ASM Amanullah, Director (T & T), BSRI; Dr. Md. Abdur Rahman, CSO & head, FMPHT Division, BRRI; Dr. Md. Israil Hossain, CSO and Head, FMPE Division, BARI; Dr. Mujibur Rahman, CSO, Jute Farming Systems Division, BJRI; Dr. Nazmun Nahar Karim, PSO, Agril. Engg. Unit, BARC; Dr. Md. Ayub Hossain, PSO, FMPE Division, BARI; Dr. AKM Saiful Islam, PSO, FMPHT Division, BRRI; Md. S. Islam Sheikh, DPD, Farm Mechanization Project, DAE and Sheikh Md. Nazimuddin, Project Director, Farm Mechanization Project, DAE Sheikh Md. Nazimuddin, Program Director, DAE as member of the sub-committee. To fulfill the government's vision a draft Agricultural Mechanization Roadmap for 2021, 2031 and 2041 prepared by committee & sub-committee and submitted to Ministry of Agriculture on 31 January 2016. This roadmap includes challenges, activities, implementation strategies, sources of fund and approximate fund for implementation etc.

Monitoring, reviewing and evaluation report of /activities of NARS institutes

1. Conducted Field Monitoring of Research Projects under Research Grant of BARC at Barisal, Bhola and Patuakhali districts during February 28 to March 3 2016. Research Projects were ‘Organic Amendments in Mungbean-T. aus-T. aman Cropping Pattern for Sustaining the Yields and Soil Fertility in Southern Region of Bangladesh’ of BARI; ‘Tracking Climate Resilient Rice varieties Developed by BRRI and Its Economic Performances at the farm Level in Bangladesh’ of BRRI and ‘Increasing fertilizer and irrigation water use efficiency for crop production in southern coastal saline soils of Bangladesh’ of Patuakhali Science and Technology University. Visited the research fields and discussed with the concerned scientists, field staffs and cooperator farmers and collected updated information on the progress of activities compared with planned activities, problems and their suggestion/action needed for smooth running of the project. Provided some on the spot suggestions regarding crop management and other project activities for smooth running of the project.

2. **Reviewed four Research Proposal** (Improvement and validation of BARI seeder for grain crops under different cropping patterns and soil conditions; Utilization of Solar Energy for Multipurpose Use; Improvement of Primary Tillage Assembly Of Riding Power Tillers Widely Used in Bangladesh and Design and development of two stage drying technique for drying of high moisture grain) **under the Researchable Area/Issue “Development and Diffusion of Energy Efficient Agricultural Machinery through public and private Collaboration”.**

3. Evaluated Project Report of “Development and popularization of value added jute-based diversified blended product” and “Development of a Mechanical Vegetable Washing Machine” under Research Grant Fund of BARC.

4. Evaluated eight AFACI projects (1. Collection, characterization and promotion of rice, chili, cucumber and melon in Bangladesh; 2. Development of locally appropriate GAP programs and produce safety information system of selected crops in Bangladesh; 3. Establishment of network and model manual on post-harvest technology of horticultural crops in Bangladesh; 4. Establishment of Agricultural Technology Information Network in Asia; 5. Construction of the Asian Network for Sustainable Organic Farming Technology; 6. Construction of Epidemiology Information Interchange System for Migratory Disease and

Insect Pests in Asia Region; 7. Development of rice Production techniques for increase of self-sufficiency of staple food in Bangladesh and 8. Improving Animal Genetic Resources Values and Productive Performance in Asia).

5. Evaluated two KGF projects namely “Design and development of two stage drying technique for drying of high moisture grain” and “Improvement and validation of BARI seeder for grain crops under different cropping patterns and soil conditions”.
6. Evaluated project proposal entitled ‘Farm machinery technology development for profitable crop production’ by BARI.

Linkage

Maintained strong Linkage with the engineering professional bodies in home and abroad like CIMMYT, IRRI, IEB, BWDB, CSAM, WARPO, BSTI, NGOs (IDE, BWP /GWP), FAO, BANCID and Universities etc.

Worked as member in the different committee as mentioned below:

1. Worked as member in the different committee as mentioned below:
 - a. Technical committee, Agricultural Mechanization Project of DAE, Dhaka.
 - b. Technical committee of Bio-gas, Infrastructure Development Company Limited (IDCOL), Dhaka.
 - c. Board of Management, National Science and Technology Museum (NSTM), Ministry of Science and Technology.
 - d. Governing Council of CSAM, United Nations Economic and Social Commission for Asia and the Pacific
 - e. BANCID Study and Publication Sub-Committee.
 - f. Science and Technology Development Trustee Board, Ministry of Science and Technology.
 - g. Technical committee ‘Agricultural Mechanization Roadmap’
 - h. Technical Advisory Committee (TAC) of KGF
2. Visited Tractors and Farm Equipment (TAFE), Chennai, India during 8-13 September 2015.
3. Participated AFACI ‘Programme-Workshop on extension’ at Bangkok, Thailand during 20-24 October 2015.
4. Arranged meeting for African Officials which was held on 3rd November 2015. The objective of this

- meeting was to learn recent success in mechanization growth in Bangladesh and apply its lesson to the policy formulations in their respective countries. Executive Chairman, Member Director (NRM) and Dr. Kshirode Chandra Roy, Former DG, BARI discussed various aspects of agricultural mechanization of Bangladesh with nine African Officials (Ethiopia, Ghana, Kenya and Nigeria) and one IFPRI officials from Washington DC.
5. Attended 4th CGIAR Advisory Committee Meeting which was held 20 December 2015 at BARC.
 6. Attended meetings/seminar/ workshops organized by FAO, CEGIS, IWM, WARPO, BARI, BRRI, BCAS and BARC.
 7. Review research paper and published following research paper in different scientific journal, proceedings and newsletter
 - i. 'Status of Demand and Manufacturing of Agricultural Machinery in Bangladesh'. 2016. *Agricultural mechanization in Asia, Africa, and Latin America* (AMA). Vol.47 (2):51-54.
 - ii. 'Research on Agricultural Machinery Development in Bangladesh'. 2016. *Agricultural mechanization in Asia, Africa, and Latin America* (AMA). Vol.47 (2):55-57
 - iii. 'Yield of three newly developed mustard varieties as affected by irrigation at different growth stages'. 2015. *Research in Agriculture, Livestock and Fisheries*, vol. 2(2):13-22.
 - iv. 'Impact of climate changes on monsoon and yearly rainfall in Bangladesh'. 2014. *J. Institution of Engineers*, Vol. 41/AE(2): 01-10.
 - v. 'Impact of climate changes on actual crop evapotranspiration of boro rice in Rajshahi Division'. 2014. *J. Institution of Engineers*, Vol. 41/AE(2): 23-30.
 - vi. 'Climate change impacts on reference crop evapotranspiration in North West Hydrological Region of Bangladesh'. 2015. *International J Climatology*, DOI: 10.1002/joc.4260.
 - vii. 'Potentials of growing upland crops in saline areas of Satkhira district using surface water and groundwater'. 2015. *BANCID Yearly Newsletter*. pp. 08-10.
 8. Contributed to publish BARC Annual Report 2014-15
 9. Contributed to publish BARC Yearly Progress Report
 10. Contributed to publish BARC Newsletter (January-March 2016)
 11. Published Training Manual 2016 on 'Use of Farm Machinery and Efficient Irrigation System Management'
 12. Worked as member in the different committee of BARC
 13. Attended meetings/seminar/ workshops organized by BARC

The Unit has the responsibility of research management in the three distinct areas under agricultural Engineering, namely, Farm Machinery, Irrigation and Water Management and Post Harvest Processing Engineering. The Unit oversees the major program being undertaken by the NARS institutes for the purpose of further improvement.

Brief Highlights of R&D of the concerned NARS Institutes

1.1 Farm Machinery

Adoption of two wheel tractor operated seeder in rice-wheat cropping system: The two wheel tractor operated seeder was demonstrated in different locations in the farmer's field of Dinajpur, Thakurgaon, Tangail, and Rajshahi area 2015-16. Recommended basal dose of fertilizers were broadcasted over the land surface before seeding operation. Some cases granular composite fertilizer like DAP was applied through machine during seeding operation. During pulses seeding, TSP was applied along with seeding operation through the machine. Wheat, maize, and lentil were planted after rice harvest and mungbean, sesame were planted after wheat harvest. The density of rice residue was 0.8-1.4 t/ha. The seeder performed seeding operation minimizing 7-9 days turn around time utilizing the residual soil moisture. It maintained uniform seeding depth, uniform seed distribution and better seed soil contact which transfer soil moisture to seeds quickly for enhance better plant establishment and yield. Application of irrigation water was faster than that of conventional method. Minimum tillage saved irrigation water for wheat and maize 14.9% and 4.8%, respectively compare to traditional irrigation method of crop cultivation. Average wheat yield was 20-25.5% higher than conventional method. Effective field capacity of the seeder was 0.13ha/h. Cost of wheat seeding was Tk.1950/ha which was 65.8% less than conventional method (Tk.5695.0/ha). This seeder

covers about 4399 ha land in Rajshahi, Tangail, and Dinajpur area. Long term on station trial (7 years), wheat yield in minimum tillage by PTOS showed higher than conventional planting system in rice-wheat-mungbean crop rotation maintaining 30% crop residue. No yield reduction trend observed over the time compare to conventional method.

Adoption of two wheel tractor operated bed planter for upland crops:

Adaptive trials of two wheel tractor operated bed planter were conducted in the farmers' field of Rajshahi, Tangail, and Rangpur area in 2015-16. The bed planter was improved and fine tuned with the introduction of operator's seat, attachment of especial size pulley for rotary speed increase and introduction of inclined plate seed metering device for planting small to large sizes seeds. The operator can drive the planter in ridding position. It solved the problem of long distance travel and enhance adoption considering the added advantage of easy comfortable operation. The size of pulley was 8.5" (216mm). Power transmission chain of the bed planter was divided into two parts avoiding shaking of chain during overcome land boundary (aiel). Both the Dongfeng and Sifeng type bed planter now available. The implement comprises of four major components, namely- rotary tilling part, furrow opener, seeding unit with metering mechanism and bed former-cum-shaper. Performance of the bed planter was tested for wheat, maize, mungbean and rice cultivation. The uniformity of maize seed spacing was 86-95%. The density of rice and wheat residue were 1.8 t/ha and 1.6t/ha in the tested plot, respectively when seeding on permanent bed. After initially forming the bed, an additional advantage was that reshaped bed can be used for next crop without any further tillage operation keeping it permanent. Fresh bed saved 21.5% and permanent bed saved 34.1% irrigation water over conventional flood method of irrigation with less number of labour involvements. Water logging problem can be avoided introducing bed planting system, especially in rainy season crops. Bed planting allows earthing up, so no need sub sequent earthing up in maize cultivation. Bed planting saved 44% tillage cost compare to conventional method. Maize planting cost in new bed and permanent bed was 63.0% and 72.5% less than conventional seeding method. Average wheat and maize yields were 3.9 t/ha and 9.8 t/ha, respectively. The same wheat and maize yield in conventional method were 2.9 t/ha and 7.5 t/ha, respectively. Yield advantage of wheat and maize were 34% and 30% over conventional method. Long term on station trial (7

years), wheat yield under bed planting showed higher than conventional planting system in rice-wheat-mungbean crop rotation maintaining 30% crop residue. Net return for wheat cultivation in fresh bed and permanent bed planting were 1.9 times and 1.8 times than conventional method. The bed planter is now using as custom hire basis in the farmers' field.

Evaluation and extension of two wheel tractor operated potato planter in the farmer's field:

A low cost power tiller operated cup type potato planter was developed in Bangladesh Agricultural Research Institute (BARI), Rajshahi which can plant whole tuber potato seeds as well as cut piece potato seeds automatically in furrows at predetermined regular intervals. Potato planter maintains a single row of spacing 600 mm and seed to seed distance 200-250 mm for whole tuber seed and 150-160 mm for cut piece seed. Performance of the planter was evaluated in the farmer's fields to determine the effect of forward speed and seed sizes on the uniformity of spacing and seed missing during 2015-16. Forward speed of 2.4 km/h is the best in respect of uniformity of spacing and missing seeds. Seed sizes of 35mm were found the best in respect of uniformity of spacing (94%) at the speed of 2.4 km/h. Field demonstrations were conducted at on station and the farmer's field of Puthia, Paba, Sibpur, Rajshahi. The average effective field capacity of cup type planter was 0.10 ha/h and missing seed was 3%. Potato planter requires 4 man-days/ha compare to 67 man-days/ha in conventional manual planting method. Potato planting cost were Tk.4804/ha. On the other hand, using whole tuber and cut piece seed, manually potato planting cost was Tk.14,740/ha and Tk.16940/ha. There are no significant yield difference between potato planter and conventional methods. Manufacturers and operator trainings were conducted under the project works. Farmers field day was also conducted near the potato field showing the crops condition of mechanically planted plots and conventional planted plots. Potato planter can save labour requirement of 63 man-days/ha and planting cost Tk. 9936/ha which was equivalent to 94% and 67% saving of labour and planting cost, respectively compare to conventional manual potato planting method.

Design and development of dry land NPK briquette applicator:

Deep placement of NPK briquettes hampered the runoff, fixation, leaching, and volatilization loss of fertilizer. But deep placement of fertilizer is a laborious job and costly. A manually operated NPK briquette applicator for upland crops was

developed at Farm Machinery and Postharvest Process Engineering Division of Bangladesh Agricultural Research Institute, Gazipur during 2014-15. The covering part of the applicator was modified to improve its performance during 2015-16. The applicator was modified for deep placement of one NPK briquette by single push. The average depth of placement of briquette was 7-8 cm. Hole coverage was 75-80 % and distance between plant and briquette was 9-10 cm. There was no missing of NPK briquette during laboratory and field tests. Average field capacity of the applicator was 10 decimal/h (depend on fertilizer requirement of crop). There were no significant differences of yields among the treatments. But maximum yields were found in NPK briquette application by hand and applicator, which are very similar. It has good response to the NPK briquette application by machine or hand for long duration crops such as chilli, brinjal, tomato, etc. This experiment will be continued to the next year for improvement of the applicator for its better performance.

Improvement and performance evaluation of an axial flow pump: Three sizes of axial flow pumps such as 76 mm (3"), 102 mm (4") and 150 mm (6") diameters and each of 4.5 m long were designed, fabricated and tested at Farm Machinery and Postharvest Process Engineering Division, Bangladesh Agricultural Research Institute, Gazipur during 2013-16. The pumps were fabricated with locally available such as MS (mild steel) pipe, MS solid shaft, MS rod, MS sheet, bearing, MS pulley, rubber bush and necessary spares. The operating power for 76 mm, 102 mm and 150 mm pumps were 10.0 hp, 12.5 hp and 14.0 hp diesel engines. All the pumps were tested at the pump testing beds of FMPE Division of BARI, Gazipur for surface water lifting at the heads of 1.0, 2.0, 3.0 4.0 and 4.5 m and pump speeds of 1800-2000 rpm. Discharges of of 76 mm, 102 mm and 150 mm diameter pumps varied linearly from 5.65 to 18.20 L/s, 16.43 to 29.24 L/s and from 40.72 to 66.67 L/s, respectively for variation of head from 1.0 to 4.5 m. For 76 mm, 102 mm and 150 mm pumps, the peak pump efficiencies and brake powers were found for the discharge of 13 L/s, 21 L/s and 46 l/s, respectively. Therefore, 76 mm, 102 mm and 150 mm diameter axial flow pumps were found technically suitable for surface water lifting. These axial flow pumps may be recommended for surface water irrigation in Bangladesh.

Comparative performance evaluation of different manual injector type USG applicators: Different

types of Urea Super Granule (USG) applicators performance were tested in three locations at FMPE Research field, RARS Jamalpur, farmer field, Gazipur. The treatments were T₁= Application of USG by the BRRI applicator, T₂= Application of USG by the BARI applicator, T₃= Application of USG by single row IFDC applicator, T₄= Application of USG push type IFDC applicator, T₅= Application of USG by hand and T₆= Prilled urea. All the treatments were replicated thrice with RCB design. The applicators were tested for BRRI dhan 28 during 2015-16. The average field capacity of the BRRI, BARI, IFDC single row and IFDC injector type USG applicators were 0.120, 0.124, 0.0456 and 0.040 ha/h respectively. In case of yield, there was no significant difference among the treatment, but comparatively higher yield in BARI double row and IFDC injector type USG applicators. The Benefit cost ratio (BCR) of the BRRI, BARI and IFDC single row USG applicators were 2.75, 2.86 and 1.07 days respectively.

Development of a low cost two wheel tractor operated potato harvester: A low cost two wheel tractor driven potato harvester has been developed with locally available materials in Farm Machinery & Postharvest Process Engineering Division of BARI, Gazipur to facilitate small farmers to harvest their potatoes at low cost. Local manufacturer can fabricate power tiller driven potato harvester easily. The developed potato harvester is a semi automatic digging machine consisting of (i) digging blade (ii) conveyer flat chain (iii) Guide plate and (iv) Power transmission arrangement with a dimension of 900 mm x 850 mm x 950 mm. The field capacity of the potato harvester covers daily average 1.2 ha land depending on operator skillness. Potato harvester requires labour 21 per ha only instead of 60 labours per ha in traditional manual method. Total cost of potato harvesting by the potato harvester is Tk. 9,835 per ha but manually harvesting cost is Tk.23,600 per ha. Potato harvester saved 58.3% potato harvesting cost and 65% labour requirement compare to traditional manual potato harvesting method. Moreover, there are no potatoes remain under the soil. Potato damage percentage is less than 1.21%. Potato farmers always pass risk of bad weather especially harvesting time. So, potato harvester can cover large areas within short period of time, escape bad weather uncertainty, and sustain potato production stable.

Modification and Performance Evaluation of a Mango Harvester: Mango harvester is mainly used for harvesting mango fruits with less drudgery, fatigue on

labour, also preventing damage to the tree branches & fruits as compared to manual plucking and tree shaking. A mango harvester was designed and fabricated of Farm Machinery & Postharvest Process Engineering Division, BARI, Gazipur during 2014-15 to reduce postharvest loss. During 2014-15, the weight of aluminium mango harvester was 4.1 kg whereas it was reduced to 2 kg during 2015-16. Furthermore, the weight of modified bamboo harvester was 1.7 kg and existing bamboo harvester was 1.5 kg. The mango was harvested from different heighted mango trees in different location of BARI campus, Gazipur and RHRS, Chapainawabganj. During 2015-2016, the highest capacity of aluminium harvester was 222 kg/h and modified bamboo harvester was 156 kg/h. When mangoes were harvested by aluminium harvester, 93% of mangoes were found with pedicel length above 1-1.5 cm whereas it was 92% for modified bamboo harvester. During 2014-2015, the initial cost of aluminium harvester was Tk 5800 and it reduced to Tk 2200 during 2015-16. The initial cost of modified bamboo harvester was Tk.1000 and existing bamboo harvester was 450. Farmer has to face problem when mango is harvested climbing on a tree because of fitting the clutch lever at the end position of harvester.

Modification and performance evaluation of a mango harvester: A mango harvester was designed and fabricated in Farm Machinery and Postharvest Process Engineering Divisional workshop, BARI, Gazipur during 2014-15 to minimize postharvest loss due to harvesting. The performance of modified harvester was compared with existing BARI mango harvester. The weight of modified harvester is 4.1kg whereas existing harvester is 1.5kg. The mango was harvested from different heighted mango trees in different location of BARI campus. The highest capacity of modified and existing harvester was found 76.15 and 72.48 kg/hr when number of mangoes per kg was 6.5% of mango with pedicel length below 1-1.5 cm was found by modified harvester which is satisfactory whereas it was 18% for existing harvester.

Development of a low cost two wheel tractor mounted mobile maize sheller: A low cost simple power tiller front mounted spike tooth type mobile maize sheller has been developed in farm machinery & postharvest process engineering division of BARI, Gazipur 2015 with a view to easy way shelling maize in the farmers' field of rural areas and eliminating botheration of transportation of traditional maize sheller from place to place. The main components of the sheller are hopper, rotating cylinder, concave, grain

delivery out let, shelled cob delivery out let, sheller fixing arrangement, main pulley with power transmission arrangement. It is an anti clockwise rotating cylinder, axial flow type sheller and grain separated with a frictional force between spike tooth and concave. The maize sheller is attached with nuts and bolts in front of the engine base of two wheel tractor (2wt). The operating power of the sheller comes from the fly wheel of the engine of the tractor through 'v' belt pulley arrangement. The average shelling capacity of the mobile sheller is 2.0 t/h, broken kernel 2.2%, and shelling efficiency 97%. The average cost of shelling maize is tk. 0.22/kg compare to traditional custom hire rate tk.1.0/kg. The service provider of the two wheel tractor can transport the mobile maize sheller long distance in operator's seating position which minimized transportation hazard of maize sheller.

Design and development of a low cost power driven tomato and potato grader: Manually grading of tomato and potato are laborious job and costly operation. A rotating cylinder type tomato and potato grader was developed in Farm Machinery & Postharvest Process (FMP) Engineering Division of Bangladesh Agricultural Research Institute (BARI) in 2015-2016. The overall dimension of the grader is 3070mm×690mm×1150mm. The grader was made of locally available MS angle bar, MS flat bar, MS rod, MS sheet, MS shaft, ball-bearing, V-belt, V-pulley, and other small items. A 4 hp diesel engine was used to rotate cylinder at 15 rpm. Four grades of potatoes were obtained from the grader through four outlets of three cylinders. These sizes were small (<28mm dia.), medium (≥28 to ≤40mm dia.), medium large (≥40 to ≤55mm dia.) and large ≥55mm. The average capacity of grader for tomato and potato were 1.34 t/h, 1.52 t/h and damage rate were found 20%, 2% respectively.

Development of a mechanical vegetable washing machine: Based on the base line information, a mechanical vegetable washing machine was designed and fabricated with locally available materials at FMPE Division, BARI, Gazipur in 2015-2016 to clean the vegetables with less cost and short time. Overall dimension of the machine is 3759 mm × 1473 mm × 1676 mm. Both the conveyer net and brush roller were operated by an electric motor of 1.1 kW. The water was flown through the pipe by centrifugal water pump of 1.1 kW. Washing time for fruit, leafy vegetables were 32 second and ranged from 2 to 3 minutes for root crops depending on the amount of dirt of surface of the vegetables. Water requirement was 3000-5000 litre per

hour. The capacities of the machine were ranged from 1 to 2 t/h for leafy, fruit vegetables, and about 0.5 t/h for root vegetables. The cleaning efficiency was about 98% and washing cost was 188Tk/t for leafy, fruits vegetables and 290 Tk/t for root vegetables. Payback periods and breakeven points were 9 days and 60h/yr respectively. BCR of the machine was 9.5. Weight of the machine is 646 kg. The price of the machine is about 250,000Taka (US\$ 3205).

Modification of a hot water treatment plant for fruits: Existing small BARI hot water treatment plant for fruits was operated mainly by electric power of 12 to 15 kW. Conveyor rollers and stirrer were rotated by a single phase electric motor and water was warmed by single phase electric immersion heaters. In rural areas, 12-15kW single phase electric lines was not available though any place available but also load shading is occurred. Traders/farmers want to connect said power electric line for any plant; authority of REB does not agree to install another new transformer. If authority agrees to install the line, trader and farmers need lot of money that is not effort for all farmers and traders. For this reason, a simple and less electricity requirement hot water treatment plant was designed and fabrication with stainless steel (SS) materials in the Farm Machinery & Postharvest Process Engineering Division of Bangladesh Agricultural Research Institute, Joydebpur, Gazipur in 2015. The overall dimension of the plant is 1600×1100×1600 mm. An electric motor of 0.38 kW used for rotation of conveyor roller and stirrer, and six electric immersion heaters of 2 kW each used. Four heaters out of six are used for treating fruits and other two heaters are used as auxiliary heaters for instantly recover the heat that absorbed by the immersion treated fruits. Four alternative heating sources were used such as chula for fire wood, LP gas burner, kerosene chula and electric heaters for heating of water upto desired level of temperature. The lowest heating cost and time was found in fire wood chula followed by LP gas chula, kerosene chula and electricity. It polluted the environment but electricity was the second lowest cost and friendly environment. The price of the plant is 1,20,000 (\$1600). This plant can be used where electricity is not available and also be used as alternative energy to electricity for heating water.

Development of a power coconut dehusker: Coconut produced about 0.37 million tons in Bangladesh. Husk of coconut is removed for getting nut and shell as raw materials in coconut oil industries and for edible purposes in household level. Husking is done manually

by sharp iron in oil industries and retail markets in our country. The work is hard and required high skill and strength. The study was undertaken to develop a power coconut husking machine for dehusking coconut easy and quickly. This study was conducted at Farm Machinery and Postharvest Process Engineering Division, Gazipur during 2015-2016. It was made of locally available MS (mild steel) materials. The overall dimension was 910×690×1130 mm. Functional parts of the machine were main frame, power transmission system, dehusking unit and electric motor. Dehusking unit consisted of two rotating spike roller made of galvanized iron (GI) pipe along with some spikes. An electrical motor of 2.24 kW was used as a prime mover. Motor rpm was stepped down from 1450 to 145 by means of gear reducer (ratio: 1:10). Operating speeds of the drive and driven spike rollers were 40 rpm and 35 rpm respectively. Weight of the machine is 250 kg. The capacity of the machine ranged from 450 to 500 coconuts per hour. The husking efficiency was 98 percent. Capacity of the machine was about three times more of the traditional husking. The breakage of nuts was found to be one percentage. Operating cost of coconut was 200 Tk per 1000 nuts. Payback period and breakeven point were 20 days and 30 h respectively. Price and BCR of the machine were 6,20,000 and 1.54 Tk. respectively. The machine would be useful for commercial purpose in coconut oil industry, wholesale and retail market for shelling coconuts.

Technical back up to manufacturers for machinery prototype development and fine tuning of existing machines: Group meeting and orientation of technical staff of machinery manufacturers were conducted for improve understanding about seeding implements in FMPE Division, BARI Gazipur 2015-16. Flute type seed metering dye produced by the local manufacture successfully and inclined plate seed metering device also produced in Rajshahi. Relationship between researchers and manufacturers improved which reflect in machinery production. Progressive farmers need to close contact with manufacturers for display machinery product and feedback collection. A Saifeng type bed planter has been developed under this programme in Rajshahi. Manufacturers are able to understand technical functioning components of the implements. Manufacturers showed interested in fabrication BARI mobile maize sheller and potato harvester.

Design and development of Mini Combine harvester: A first prototype of mini combine harvester was fabricated at the Janata Engineering Workshop, Chuadanga under Public Private Partnership approach.

BRRRI provide design, drawing, technical and financial support to the workshop. The preliminary test was conducted during wheat and *Boro* 2015-16 season. The field performance was found 0.17~0.23 ha/h and observed different types of mechanical faults. The fuel consumption was 3.50 to 3.80 l/h. Taking in consideration of the identified faults, improvement of second prototype is under process.

Design and Development of a Single Row Conical Weeder: A push-pull type single row conical weeder was designed and fabricated in the FMPHT divisional research workshop. A preliminary test was conducted to find out mechanical faults. Float angle of the skid was considered as 25° which helps to make slippage of the rotor. There are 6 smooth and 6 serrated blades on the periphery mounted alternately on the rotor to uproot and burry weeds with traction and shear force when the rotors create a back and forth movement in the top of soil. The effective width of the conical weeder was found 103 mm.

Development of a Power Chopper Machine: A power chopper was developed to chop straw for cattle feed, mushroom bed and briquette materials in specific size. The performance test was conducted in FMPHT research workshop and five other places, BLRI Savar, Shajadpur of Sirajganj, Chuadanga, Jessore and Rangpur. The chopping capacity of engine operated chopper was found 280kg/h dry rice straw, 1000 kg/h fresh rice straw, 675kg/h fodder and 600kg/h small branches of trees. The fuel consumption of the chopper machine was measured at different gear ratios and the values were varied 0.08 - 0.12 l/h. The cost saved by the power chopper was about 94% and 96% over manual chopper and conventional method of chopping respectively.

Effect of settling period of soil on performance of Rice Transplanter: Rice transplanting by machine is very important and crucial issue in Bangladesh due to labour shortage in peak period of transplanting seasons. So the performance of rice transplanter in different soil condition is also imperative for getting proper functioning of the machine. Three types of rice transplanter were evaluated with respect of different settling period in this study. Among the three rice transplanter, two were walking type and another one was riding type. The desired depth of planting of 3 to 4 cm was observed for T₂ and T₃ at settling period of 56 hours. The minimum percentages of floating, mechanical damaged and missing hills were recorded at 32 hours settling period for all the transplanters. The

percentage of buried hills decreased with the increase in settling period for all the transplanters. The lowest percentage of hill mortality was observed at settling period of 32 hours in riding type rice transplanter and walking type two rows rice transplanter. However, lowest percentage of hill mortality was observed at 48 hours in walking type four rows rice transplanter. In clay loam soil, 32 hours settling period was most suitable for operating riding type and two rows walking type rice transplanter while a settling period of 48 hours was suitable for operation of walking type four rows rice transplanter.

Performance Evaluation of BRRRI Manually Operated Rice Transplanter: A manual rice transplanter was fabricated at FMPHT research workshop. The performance test was conducted during *Boro* 2015-16 season at BRRRI HQ research plot using 30 day's old (3-4 leaf) seedling of BRRRI dhan28. The field capacity was found 0.033 ha/h at an operating speed 0.421 km/h. The transplanter successfully transplanted seedlings on an average hill-to-hill spacing 21 cm and 6 cm depth with 5-7 seedlings/hill. The missing and floating hills were observed 7.19% and 5.93% respectively. It was found that buried hill were 1.33/ m² during the operation.

Study the effect of N₂ application method on crop performance: The performance of BRRRI Prilled Urea Applicator was evaluated at farmer's field. BRRRI prilled urea applicator can be saved up to 30% urea without scarifying rice yield. In addition, there is no obligation to maintain proper hill to hill distance because Prilled Urea Applicator drops urea continuously. Farmer may be suggested to apply BRRRI Prilled Urea Applicator for saving urea, so that they will be economically benefited.

Development of BRRRI Panicle Thresher: The performance of BRRRI panicle thresher was tested for threshing paddy. Straw remain unchanged after threshing. The threshing capacity was obtained 300 kg/h. This machine can be used as an alternative to winnower. The winnowing capacity of the thresher was obtained 1500 kg/h. Very few broken grain was observed during threshing.

Modification and Evaluation of Closed Drum Thresher: Existing BRRRI close drum thresher (TH-7) was modified and evaluated. The modified components of the thresher were pulley, frame, bearings, sieve, camshaft and cam. The performance evaluation of the thresher was done at BRRRI HQ during *Aman* 2015

season using BRR1 dhan51 at moisture content of 25% (wet basis) and cylinder speed of 600, 650 and 700 rpm. The modified thresher has an average threshing capacity of 912 kg/h. The threshing efficiency reduces from 99.45 to 99.43% as well as cylinder loss reduces from 0.21 to 0.12% with increase in cylinder speed. However, separating loss was increased from 0.35 to 0.45% with increases cylinder speed. Nevertheless, the lowest gross loss was found at cylinder speed 650 rpm.

Test and evaluation of reaper binder: The reaper machine can't be popularized due to scatters of harvested paddy and lack of binding facilities. The actual field capacity of reaper binder was 0.313 ha/h at an average operating speeds of 3.2 km/h. The average fuel consumption was found 657.50 ml/h. The cutting height was found 8-35 cm from ground level which is quite similar to traditional sickle cutting. As the reaper binder has binding facilities and overall field performance found quite good, so this reaper binder might have the potentiality using in farmers field until the period of fully introduced of combine harvester.

Test, Evaluation and Modification of Rubber Roll de-husker: A de-husking machine was developed to improve the performance of existing engelberg huller. The capacity of developed de-husker was 500 kg/h and hulling efficiency was more than 90% in one pass. The head rice recovery was increased by 1-2% due to use of de-husker. In addition, bran and husk can be used for extracting bran oil and making briquette respectively.

Improvement of air-blow type engelberg huller: Modified air blowing type (one-pass) huller was developed for processing parboiled and un-parboiled paddy. FMPHT division take initiative to process un-parboiled paddy with this huller by reducing rotor rpm with different sizes of pulley. Among the four size of pulley, 223 mm size with 811 rotor rpm produced 48% head rice (based on input paddy supply) which found promising. It is noticed that, in the field engelburg huller operate at 1200 rpm that's speed suitable for parboiled rice processing, at that rpm un-parboiled paddy produces more broken rice. In this experiment, 1200 rpm for processing un-parboiled paddy gives lowest head rice recovery (35%) and highest broken rice (32.5%) percentage. Farmers and millers both will be benefited by using modified huller mill for both parboiled and un-parboiled paddy in single pass operation.

Fabrication and installation of air blow type rice mill in farmer's field: A total 12 air blow type rice

mills were fabricated at local manufacturing workshop Jamtoly, Ashulia, Savar, Dhaka. Seven of them were distributed and installed at farmers house under the supervision of BRR1 and the rest of five were installed at NGO site under direct supervision KOICA Bangladesh office. The milling capacity of installed rice mill was an average 180-200kg/h and doesn't commercially cost effective.

Milling quality evaluation of BRR1 dhan63 milled in different type of rice mill: As BRR1 dhan63 is premium quality rice, it could not be milled as un-parboiled condition in existing steel engelberg huller mill effectively. It could be milled in semi and auto rice mill successfully as parboiled and un-parboiled condition. However, it needs to follow special drying, everyday four hours drying and followed by stacking for tempering and continues three to four days to remove moisture content up to 12%.The head rice of laboratory, air blow type and semi-auto rice mill was 92, 83.25 and 86.75% respectively as parboiled condition (based on total milled rice), whereas 90, 70.50 and 81.25% was for un-parboiled condition respectively. The degree of milling was found 10.15, 12.45 and 16.30% in laboratory, semi-auto and air blow type rice mill respectively.

Farm level evaluation of mechanical rice transplanter in Rangpur and Jhenaidah district during cold season: Fuel consumption of 4-row walking type mechanical transplanter obtained 5.25 L/ha. The field capacity and field efficiency of rice transplanter obtained 0.11-0.12 ha/hr and 64-70 percent, respectively. Conventional seedbed preparation required 37-55 man-hr/ha whereas 71-77 man-hr/ha required in mat type seedling suitable for mechanical transplanting. Labor requirement in manual and mechanical transplanting ranged from 123-150 and 9.0-10.5 man-hr per hectare which was 19-22 and 1.65-2.00 percent of total labor requirement in rice cultivation, respectively. Mechanically transplanted plot showed significantly higher grain yield (9-14%) than hand transplanted method due to use of infant seedling and better planting efficiency. Mechanical transplanting reduced 1.8 percent input cost than manual transplanting in crop cultivation. Mechanical transplanting systems increased yield, improved labor efficiency, ensured timeliness in operation and faster transplanting.

Evaluation of BRR1 prilled urea applicator at farmer's field: The field capacity of the BRR1 prilled urea applicator (PUA) and BRR1 USG applicator

(USGA) obtained similar almost i.e. 0.09-0.10 ha/hr in both locations. Field efficiency of PUA and USGA obtained 64-65 and 67-69 percent, respectively. PUA and USGA saved 29-32 percent urea fertilizer compared to hand broadcasting (HB). Urea application method gave insignificant effect on grain yield. Only urea fertilizer cost varied and other input cost in the form of labor and material obtained similar in all urea application plot. PUA and USGA reduced 2-2.5% input cost than HB in crop cultivation. BRRRI prilled urea applicator and BRRRI USG applicator safely dispensed urea fertilizer in subsurface and save huge amount of urea fertilizer without sacrificing grain yield.

Comparative performance of BRRRI mechanical and power weeder at farmers' field: The highest weed control efficiency obtained with BPW (78%) and the lowest (76%) in BMW. During weeding operation, BPW damaged lowest (9%) plants compared to BMW (11%). The effective field capacities were 0.06 and 0.09 ha/hr for BMW and BPW, respectively. The lowest labor requirement was 582 man-hr/ha for BPW and the highest was 650 man-hr/ha for HB. Weeding cost showed highest in HB (Tk 4287/ha) followed by BMW (Tk 1103/ha) and BPW (Tk 950/ha). HB showed the highest weeding cost (78%) compared to BPW. BPW reduced the production cost. Weed control methods showed insignificant effect on grain yield. BPW and BMW showed encouraging weed control efficiency, saved weeding cost without sacrificing grain yield and appeared as environmentally safe weed control technology in low land rice cultivation.

Field trial and demonstration of promising farm machinery and technology to the LFS farmers under IAPP project: Field trial of farm machinery and technology was conducted in the LFS farmer's plot Barisal, Patuakhali, Nilphamari and Rangpur district during *aman* 2015, *boro* 2015-16 and *aus* 15 season. Rice variety BRRRI dhan44, BRRRI dhan52 and BRRRI dhan29 were grown in the trial plot. Rice seedling transplanted by mechanical transplanter in 17 cm space setting produced the highest grain than the close space setting (13 and 15 cm). Mechanically transplanted rice produce 16% higher grain yield than manually transplanted rice due to use of tender aged seedling. Prilled urea applicator safely dispensed urea in subsurface and produced highest grain yield hand broadcasted field. During this year, 98 farmers were trained on the operation and maintenance of farm machinery and technology.

Capacity building and field demonstration on farm machinery and technology under Mujibnagar project: Performance of mechanical rice transplanted rice was compared with manual transplanting. The row to row spacing was fixed at 30 cm whereas plant to plant spacing can be adjusted in mechanical transplanter (30x13, 30x15 and 30x17 cm). BRRRI dhan39 and BRRRI dhan62 were the rice varieties used at Aman/2015 season. BRRRI dhan28 and BRRRI dhan29 were cultivated in the field trial of *Boro* 2015-16 season. Other agricultural input such variety, fertilizer and crop management were same. Field trial of mechanical rice transplanter, BRRRI Prilled urea applicator and USG applicator was conducted in different location. There has no yield difference between mechanically transplanted and manually transplanted rice. In BRRRI USG applicator trial, the plant spacing was used as 20x20 cm and compared with manual placement of USG and hand broadcasting of prilled urea. The treatments were deep placement of USG by BRRRI USG applicator, deep placement of prilled urea by BRRRI prilled urea applicator and hand broadcasting of prilled urea. The grain yield of USG applied plot was slightly lower than the other two treatments. It was proven that USG saved urea. BRRRI USG applicator made easy placement of USG in the rice field which reduced the drudgery of the farmers. The farmers were satisfied about the performance of farm machines. To train up the farmers about the farm machineries, 19 training programs were conducted during *aman* 2015, *boro* 2015-16 seasons and *aus* 2015 at different location within the project areas. Altogether 475 participants were attended in the training program.

Enhancement of crop productivity and reduction of production cost using farm machinery under PGBIADP project: Adaptive trial and field demonstration of seedling raising technique, transplanting by mechanical rice transplanter, urea application by prilled urea applicator and weeding by BRRRI weeder were conducted in 13 and 14 places of Gopalganj and Pirojpur districts during *aman* 2015 and *boro* 2015-16 season under PGB project. Mechanically transplanted rice produced the highest yield than manually transplanted rice due to use of tender aged seedling. The grain yield was the highest in prilled urea application by BRRRI prilled urea applicator followed by hand broadcasting of urea due to uniform placement of urea in subsurface. Efficacy of deep placement of prilled urea was always higher than hand broadcasting. BRRRI weeder reduced the weeding cost. Six (6) training programs on "seedling raising technique and

operation & maintenance of farm machinery” were conducted during aman 2015 and boro 2015-16 seasons in different location within the project areas. Altogether 347 participants were attended in the training programs.

Design and development of power transmission system of a self-propelled power unit for multiple use:

A gear box of self-propelled power unit was developed in BRRRI research workshop. Power transmission unit of the reaper was tested in paddy and wheat field and its’ performance of reaper was found satisfactory. This gear box is functionally well but it is little bit heavy. So, it is necessary to design a new gearbox with compact size and reduced weight. In this machine for easy power transmission, a gearbox with mechanism of two forward and a backward speed have been designed with the help of AutoCAD tools and developed at BRRRI Research Workshop. Fabrication of power transmission system is going on. It will be tested very soon.

Design, development and modification of self-propelled reaper:

The performance of the self-propelled reaper was found satisfactory. The existing gear box has a provision of two forward speeds with a backward speed. When engine is started, all gears in the gear box move either engaging or disengaging clutch. Backward gear always moves but keeps idle when the reaper is in forward motion. Power is transmitted in reduced form from gear box to axle through chain and sprocket.

Modification of reaper travelling wheel for wet-land condition:

The reaper travelling wheel was modified by increasing the width of the wheel and fabricated at BRRRI Research Workshop. The width of reaper travelling wheel was increased to resist the soil resistive force. It has been tested in the wet paddy field at BRRRI farm, Gazipur. It performed well at wet land condition due to the increased contact area between the reaper travelling wheel and soil. Now, there is a problem in tail-wheel to operate it in wet land. So, it is necessary to design a tail-wheel to overcome this problem.

Determination of tilling efficiency of power tiller at selected areas of Bangladesh:

The effects of tillage depths on grain yield of BRRRI hybrid dhan2 in Boro 2015, BRRRI dhan28 in Boro 2014 and BRRRI dhan56 in Aman 2014 seasons were varied from different tillage depths. Highest grain yield of BRRRI hybrid dhan2 (breeder seed) in Boro 2015 season was found 1.60 t/ha

in the tillage depth up to 6-7 inch and the lowest yield was found 1.35 t/ha in the tillage depth up to 4-5 inch (Table 1). Table 1 showed the highest grain yield of BRRRI dhan28 was found 7.50 t/ha in the tillage depth up to 6-7 inch and the lowest yield was obtained 6.88 t/ha in the tillage depth up to 4-5 inch in Boro 2014 season. Table 1 also showed the highest grain yield of BRRRI dhan56 in Aman 2014 season was found 5.40 t/ha in the tillage depth up to 6-7 inch and the lowest yield was found 4.40 t/ha in the tillage depth up to 4-5 inch. The highest yields of all the seasons were found under the higher tillage depths up to 6-7 inch and the lowest yields were obtained in the tillage depth up to 4-5 inch (Table 1). The deep tillage (6-7 inch) might have favored the roots to proliferate down into the deeper layers of the soil profile to extract more nutrients and moisture that has led to higher growth and yield of both the seasons. Higher tillage depth favorably influenced the soil-water-plant ecosystem, thereby improved crop yields.

1.2 Irrigation and Water Management:

Determination of crop co-efficient values of soybean by lysimeter study:

The experiment was conducted on soybean (variety BARI Soybean-6) during the month of mid- November to last week of March in a lysimeter (dimension: 1 m X 1 m X 1 m size) which measures the daily evapotranspiration of the crop (ET_c) and crop coefficient (K_c) value from 2015 - 2016 at Irrigation and Water Management Division, Bangladesh Agricultural Research Institute, Gazipur. The study was examined by applying four levels of irrigation at an interval of 10, 15, 20, and 25 with allowing drainage within and adjacent of four lysimeter tanks. Irrigation at 15 days interval produced the highest seed yield and was considered to be suitable for estimating ET_c and K_c . Seasonal highest ET_c was found at 371.18 mm/day. The K_c values of soybean at initial, development, mid-season and late season were found to be 0.67, 1.46, 1.59, and 0.62. These values were found higher than the value recommended by FAO although both followed Penman-Monteith equation for estimating ET_o , but variable was only location, and climatic parameters.

Effect of water stress at different growth stages on the yield of mustard:

This experiment was conducted at BARI, Gazipur, and at the farmer’s field of Shympur, Rajshahi during the rabi season of 2015 - 2016 with BARI Sarisha-14. There were five irrigation treatments, each replicated thrice in a randomized complete block design. Basin irrigation method was

used. It was found that deficit irrigation (DI) utilized less seasonal water use to produce the highest yield, water productivity, percentage water saved, and net return in compared to full irrigation. This irrigation reduced some plant growth (biomass and LAI) in compared to full irrigation. Seasonal water use and WP were found to be 107.05 mm, 116.05 mm, 1.58 kg/m³ and 1.23 kg/m³ was found by applying DI_{80%} up to FC at pre-flowering stage for Gazipur and Rajshahi. This treatment saved more than 50% water to produce 1.58 t/ha and 1.23 t/ha yield in both locations. This treatment also gave the highest net return of 1.94 lakh and 1.74 lakh Tk. per ha of land. From this study, it can be said that BARI Sarisha-14 at DI_{80%} at pre-flowering stage can produce the highest yield for water scarce regime if soil moisture at the sowing time is at the available condition.

Response to available soil moisture on the growth and yield of chickpea: The experiment was conducted at the experimental field of IWM Division, BARI, Gazipur and farmers field of Godagari, Rajshahi during 2015 -2016 to investigate the response to available soil moisture on growth and yield of chickpea. Four levels of irrigation were applied for the experiment with four replications. Treatments were T₁= Rainfed, T₂= one irrigation (light irrigation of 1.0-1.5 cm) at post-sowing, T₃= one irrigation (light irrigation of 2-3 cm) at pod development (80-85 DAS) stage, T₄= Two irrigations given each at post-sowing and pod development (80-85 DAS) stages. The results showed that most of the parameter's value was found higher in treatment T₂ and T₄. The growth parameters (root length, shoot length, biomass) were found almost the highest in higher water used treatment and the lowest was found in rainfed treatment. The soil moisture of treatment T₂ was higher than other treatments in vegetative stage to before the pre-flowering (50 DAS) in Gazipur and it was also seen that treatment T₁ produced comparatively less biomass than treatment T₂. The treatment T₂ gave the highest seed yield in both the locations at Gazipur (1.55 t/ha) and at Rajshahi (1.33 t/ha), where one irrigation (light irrigation of 1-1.5 cm) was applied at post sowing stage. Seedling stage was the critical stage of chickpea. This treatment saved about 80% of water than the highest water used treatment. The highest BCR of 1.52 was found at Gazipur for this treatment. So, one light irrigation at the post sowing stage was suitable to get the highest yield of chickpea in this semiarid region.

Testing of aqua crop model in simulating yield response of maize to full and deficit irrigation

conditions in bangladesh: Accurate crop models are important tools for predicting crop yields to optimize irrigation under limited available water for enhanced sustainability and profitable production. The FAO AquaCrop model predicts crop productivity, water requirement, and water productivity under water limiting conditions. The performance of AquaCrop model was evaluated for maize using data from a field experiment conducted in the research field of IWM Division, BARI, Gazipur, Bangladesh during winter season of 2015-2016 with different irrigation scenarios. The model predicted the aboveground biomass and grain yield with acceptable accuracy under rainfed, full and deficit irrigated conditions. The predicted values of final aboveground biomass were within 16% of the measured values while the predicted maize grain yields were within 6% of measurements, except in the rainfed treatment, with errors up to 15.63%. The results showed high goodness of fit between the observed and the simulated biomass yield for all treatments with index of agreement (d) values ranged from 0.96-0.98, root mean square error (RMSE) from 1.11-1.26 t/ha and model efficiency (E) of 0.96-0.98. Aqua Crop's high reliability for the simulations of grain and biomass yield implies that, it can be used as a valuable tool for estimating crop productivity under various irrigation strategies.

Effect of alternate wetting and drying furrow irrigation on the yield and water productivity of maize: Efficient irrigation method is very much essential in the areas where water resources and application methods are limited for irrigation. Therefore, a new method of irrigation was used to investigate the effect of alternate furrow irrigation on crop performances, seasonal crop water use (SCWU), water productivity (WP), and nutrients uptake concentration in grain of maize (BARI hybrid maize-9) at Irrigation and Water Management research field, BARI, Gazipur and Agricultural Research Station, BARI, Dinajpur. The field experiments were laid out in randomized complete block design in a split plot design with nine treatments replicated thrice. The treatments were accommodated by three irrigation levels (I₁, I₂ and I₃: Irrigation water applied to 100%, 80% and 60% field capacity, respectively) and three irrigation methods (M₁, M₂ and M₃: Alternate wetting and drying furrow irrigation (AWDFI), fixed wetting and drying furrow irrigation (FWDFI) and traditional furrow irrigation (TFI), respectively). Results showed that AWDFI could maintain approximately similar grain yield compared to TFI with almost 37% reduction in

irrigation water when irrigated to 100% FC. The interactive effect of irrigation levels and methods had significant effect on dry matter (DM) and grain yield among the treatments while the same level of irrigation produced insignificant differ between the treatment of AWDFI (M₁) and TFI (M₃) methods. AWDFI (M₁) and TFI (M₃) obtained significantly better DM and grain yield compared to the FWDFI (M₂) method. On average, AWDFI and TFI produced around 8.13 t/ha and 8.10 t/ha, respectively in Gazipur over two years (2015 and 2016) and 9.48 and 9.89 t/ha in Dinajpur, respectively during 2015, when irrigation water was applied to 100% field capacity. AWDFI saved 37, 34 and 31% SCWU at Gazipur over two years of 2015 and 2016 and 27, 24 and 19% SCWU at Dinajpur compared to TFI when irrigation water was applied to 100, 80 and 60% FC, respectively during 2015. WP was substantially improved by AWDFI. WP was higher around 38, 34 and 31% in Gazipur and 23, 22 and 19% in Dinajpur in AWDFI system than TFI when irrigating with 100, 80 and 60 % FC, respectively. However, AWDFI (M₁) is an effective and water-saving irrigation technique which improves water productivity without insignificant yield reduction and may have the potential to be used in drought fields where maize production is heavily dependent on irrigation.

Growth and yield of sweet orange as influenced by timing of fertilizer application and method of irrigation: This study was carried out at the experimental field of Irrigation and Water Management Division, Bangladesh Agricultural Research Institute, Gazipur to determine the appropriate timing of fertilizer application and the irrigation method on the growth and yield of sweet orange. The experiment was designed with five treatments with five replications. The treatments were: T₁ = Rainfed (normal practice), T₂ = Irrigation at 10 days interval by ring basin method (November-May) with recommended fertilizer applied two times in a year, T₃ = Irrigation at 15 days interval by ring basin method (November-May) with recommended fertilizer applied four times in a year, T₄= Drip irrigation at five days interval (November-May) with fertilizer application at two months interval, T₅ = Drip irrigation at five days interval (November-May) with fertilizer application at once in a month. Results of this study indicated that the plant height and stem diameter were observed greater in treatment T₄ than other treatments. Yield contributing parameters (fruit length and diameter) and total yield were found almost similar trend in T₂, T₃, and T₄ but higher than T₁ and T₅. The treatment T₄ with drip irrigation at five

days interval with fertilizer application at two months interval is performing better plant growth than other treatments. Seasonal irrigation water use was lower in treatment T₄ and T₅ than T₂ and T₃ in each year. Drip or ring basin method could be an irrigation strategy for sweet orange cultivation due to better plant growth, number of fruits, fruits length and diameter, yield and water use.

Effect of alternate furrow irrigation on growth, yield, quality and water productivity of potato: New irrigation method of alternate furrow irrigation (AFI) was studied on potato cultivation at the research field of Irrigation and Water Management Division under Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur during dry (rabi) season of 2015-2016 to assess the dry matter, tuber yield, water productivity (WP) and N, P, K, Zn, B and total soluble solids (TSS) content in tubers in respect to irrigation levels and methods. Therefore, a factorial field experiment was conducted as a randomized complete block design with six treatments replicated thrice. The treatments were consisted of two irrigation levels and three furrow irrigation methods. Two irrigation levels were (i) I₁: Irrigation at growth stages of stolonization stage (20-25 DAP), tuberization stage (40-45 DAP) and at tuber enlargement stage (60-65 DAP) (ii) I₂: Irrigation at 12-15 days interval. Three irrigation methods were consisted of (i) alternate furrow irrigation (AFI), (ii) fixed furrow irrigation (FFI) (iii) every furrow irrigation (EFI). Results showed that dry matter and tuber yield of potato did not differ significantly between the treatments of AFI (tuber yield: 22.65 t/ha) and EFI (tuber yield: 24.27 t/ha), but significant difference was observed in AFI and EFI compared to FFI (tuber yield: 20.02 t/ha). AFI saved irrigation water by 35% compared to the EFI. WP was substantially improved by AFI. AFI improved WP by 33.6% compared to EFI when irrigated with 15 days interval. N P K Zn and B content in tubers were found similar in AFI and EFI. Tuber quality on TSS was found to be non-significant in AFI (6.3 °Brix) and EFI (6.63 °Brix) under the irrigation level of I₁. However, AFI is a useful water-saving irrigation technique which may be as an alternative choice compared with EFI in the areas where available water and supply methods are limited to irrigation.

Growth, yield and quality of mandarin and sweet orange as influenced by different methods and levels of irrigation: The experiment was conducted at RARS, Akbarpur, Moulvibazar on existing orchard to investigate the growth, yield and quality of mandarin

and sweet orange influenced by different methods and levels of irrigation from December 2013 to April 2016. Kamala lines 26, 27 and BARI Malta-1 were used as the test crops. The experiment was conducted with 6 years (orange) and 4 years (sweet orange) old plantation. The four treatments were distributed in a randomized complete block design with four replications. The plant spacing was 4m x 4m for orange and 3.5m x 3.0m for sweet orange. The treatments were T₁: Rain fed, T₂: Irrigation applied at 10 days interval by ring basin method, T₃: Irrigation applied at 15 days interval by ring basin method, T₄: Irrigation applied through drip system at 3 days interval. Measured amount of water was applied to each plant at several intervals to maintain the soil moisture content at the root zone up to field capacity. In irrigated orange and sweet orange plants, growth showed more vigorous than non-irrigated plants. The result revealed that most of the parameters were higher in treatment T₄ where drip irrigation was applied. The highest and the lowest yield of orange 1553 kg/ha and 501 kg/ha were obtained by treatment T₄ and T₁, and in sweet orange 8449 kg/ha and 2335 kg/ha, were obtained by treatment T₄ and T₁ respectively. While, the highest yield was obtained from treatment T₄, Drip irrigated treatments resulted in higher water productivity (5.55 kg/m³ for orange and 12.83 kg/m³ for sweet orange) with minimum value in comparison to that with ring basin irrigation method (2.43 kg/m³ for orange and 6.49 kg/m³ for sweet orange). The higher BCR was also observed in drip irrigated treatment (T₄).

Effect of irrigation amount and frequency on the growth and yield of onion under sprinkler irrigation: The effect of sprinkler-irrigation with 60, 80, 100 and 120% ETc regimes at the frequencies of 6-, 9- and 12- day intervals was investigated for onion (*Allium cepa*) grown on sandy loam soil in the Research field of IWM Division, BARI, Gazipur during November 2015 to March 2016. All frequencies of a particular irrigation treatment received the same amount of irrigation water throughout the season. Results showed that both irrigation regime and irrigation frequency caused a significant ($P \leq 0.05$) variation in bulb yield of onion. Irrigation frequency at 12- day interval produced the lowest bulb yield at all levels of irrigation regimes, so should be avoided for onion crops. Irrigation at 6- and 9 -day interval produced the higher yield comparable to each other. Deficit irrigation regimes (60% ETc and 80% ETc) gave the better results under 9-day frequent irrigation than under 6-day frequent irrigation. This was reverse

in case of higher water regimes. Bulb yield increased significantly at each irrigation level from 60% ETc to 100% ETc; however from 120% to 120% ETc the increase in yield was insignificant. Thus irrigation at 6-day interval with 120% ETc produced the highest bulb yield of 15.27 t/ha, while the second highest yield of 14.87 t/ha occur at 100 % ETc irrigation regime at 9-day interval. In all cases, 12-day frequent irrigation resulted in lower yields than other irrigation frequencies. WUE ranged between 6.32 and 7.41 kg/m³ for 6-day frequent irrigation, between 6.76 and 7.91 kg/m³ for 9-day frequent irrigation with maximum value in 80% ETc and minimum value in 60% ETc. Irrigation frequency at 12-day resulted in poor WUE ranged from 4.58 kg/m³ for 60% ETc to as much as 6.72 kg/m³ for 100% ETc as water supply at longer interval leads to lower yields than 6- and 9-day frequent irrigations. Thus irrigation frequencies found to be important with irrigating at 6- or 9-day interval instead of 12-day interval leading to an increase of the root-zone water storage, higher water productivity and higher yields.

Technical and economical feasibility of solar pump irrigation for crop cultivation in comparison with other power sources: Solar powered water pumping system plays an important role in irrigation and water management. It is necessary to compare the economic and technical feasibility for crop production to develop data base for irrigation experts, policy makers, farmers and private entrepreneurs and water management. Therefore, this study was undertaken to assess the technical and economic analysis of solar, diesel and electric powered water pumping for irrigation at different locations in Bangladesh. Primary and secondary data were collected through direct formal and non-formal field survey, monitoring and via questionnaire for farmers by researchers in 2015 and 2016. A total of 12 samples for solar powered irrigation system, 2 samples for solar powered irrigation with household electrical-grid supply system, 4 samples for electric powered irrigation pump systems and 4 samples for diesel powered irrigation pumping system were randomly selected for this study. Other information was gathered from national and international experiences, related past literatures in this field. In this study, five case studies (two solar powered, two electric powered and one diesel powered irrigation system) were randomly selected for details economic analysis to assess and compare the benefit cost ratio (BCR), internal rate of return (IRR) and net present value (NPV). The survey study indicated that

the cost of irrigation water pumped using solar photovoltaic with accessories was between Tk 2,413,010 and Tk 5,500,000 with the panel capacity range from 4.2 kW to 14kW, compared to Tk 25,000–Tk 35000 with the capacity range between 2.98kW and 4.48 kW by diesel powered pumping and Tk 120,000 – Tk 1,000,000 with the capacity range from 3.73 kW to 18.65 kW by pumping electric powered source. The highest gross margin was estimated from electric powered irrigation compared to solar and diesel powered irrigation system for various crops cultivation, while lower gross margin was estimated from diesel powered irrigation pumps due to lower gross irrigated area for crops production. Among the case studies, BCR was found 0.10 and 0.05 in solar powered irrigation and solar powered irrigation with household electrical-grid supply system, respectively. IRR and NPV were found negative which indicates that these systems are not economically profitable. Similarly, the other power sources, such as, diesel powered irrigation system and electric powered irrigation for DTW (Submersible pump) system were found not economically profitable. BCR, IRR and NPV were found highest 1.39, 44% and Tk 2,00,511 in electric powered irrigation (centrifugal pump) system compared with other power sources, which indicates that this system is profitable. Based on existing farmers' field condition, as is evident by now, solar powered irrigation pumping system are high initial costs. However, an economic evaluation of solar powered system could be considered in future for its multipurpose uses such as, solar-cum-diesel powered irrigation pumping system for crop production and drinking water supply, electrification to villages for providing lighting, fans and lighting at street, water supply for fish culture and other community services like as telecommunication.

Impact of irrigation water salinity on growth, yield and water use of wheat: A field experiment was conducted at the experimental field of IWM division of Bangladesh Agricultural Research Institute, Gazipur during December- March, 2014-2015 and 2015-2016 to investigate the effect of irrigation water salinity on the growth, yield components and yield of wheat. Irrigation with four fixed levels (4, 7, 10 and 13 dS/m) and one varying levels (salinity increased as plant grow older) of saline water were compared with fresh water (<0.5 dS/m) irrigated (control) treatment. All the growth and yield components were negatively affected by irrigation with different levels of saline water. The decreases of growth and yield parameters were not significant up to

the salinity of 7 dS/m. Beyond this, a strong negative effect was observed on almost all growth and yield contributing parameters like plant height, rooting density, leaf area index, spike length, spikelet per spike, number and weight of grain per spike, 1000- grain weight and biomass yield. In all cases, the highest values were recorded in control and the lowest were recorded in higher level of salinity (for 13 dS/m in the first year and 16 dS/m in the second year). Irrigation with saline water of 4 dS/m and fresh water gave identical results in term of growth, yield and yield contributing parameters. Over the years, the highest grain yields of 5.14 and 4.29 t/ha were found in the control treatment and low salinity treatment in the first and second season, respectively, while the lowest yield of 3.58 and 3.03 t/ha was found in the high salinity treatment. On average, compared to the low salinity level, medium (10 dS/m) and high salinity (13 dS/m) levels reduced the grain yield by 20.65 and 31.72% and biomass yield by 20.1 and 33.0%, respectively. Whereas varying level of salinity reduced the grain yield only by 10.24% and biomass yield by 15.88%. The water use by the crop ranged from 204 to 258 mm in the first season and 212 to 283 mm with maximum in no salinity treatment and minimum in high salinity treatment. Applying varying level of salinity gave almost similar results in terms of growth, yield and yield components with 7 dS/m salinity level. This treatment gave the highest water productivity of 1.70 and 1.88 kg/m³ in the first and second season, respectively, with 223 and 243 mm of total water use. Therefore, irrigation with low saline water at the early growth stages and higher salinity water at the later stages might be a good option for growing wheat in saline environment.

Conjunctive use of saline and fresh water for crop irrigation in coastal areas of Bangladesh: An experiment was conducted at the Agricultural Research Station, Benerpota, Shatkhira; Bangladesh Agricultural Research Institute during rabi season of 2015-2016 to investigate the response of mustard and maize to conjunctive use of saline and fresh water for irrigation. Groundwater with marginal salinity of 1.2-1.8 dS/m was considered as fresh water, whereas water (4.6-7.2 dS/m) from nearby canal was considered as saline water. For mustard there were four irrigation treatments, on the other hand five irrigation treatments were set for maize. For both crops the number of irrigations, crop growth stages, and sources of irrigation water were varied among the treatments. The experimental results showed that different irrigation

treatments have statistically non-significant effect on yield attributing parameters (Plant/ m², plant height, no. of branches/ plant, no. of pods/ plant, no. of seeds/ pod, and 1000 seed weight) of mustard. Except the number of plant/ m², all other yield attributes were found maximum for treatment (T₂) with one irrigation at vegetative (25-30 DAS) stage with fresh water and another irrigation at pod formation (50-55 DAS) stage with saline canal water (traditional practice). However, the values of yield parameters were not much lower in treatment (T₃) with fresh water irrigation at vegetative (25-30 DAS) stage and saline canal water irrigation at pod formation (50-55 DAS) stage. The yield values of these two treatments were also very closer. Seed yield and straw yield of mustard were 1.567 t/ha and 3.850 t/ha, respectively in T₂, whereas the corresponding values in T₃ were 1.503 t/ha and 3.567 t/ha. Yields of the mustard were significantly reduced in treatment with single fresh water irrigation, and in treatment with two saline water irrigation. Yield attributes of maize also did not vary significantly among different irrigation treatments. Plant height, number of cob/ plant, number of grain/ cob, and 1000 grain weight were found highest in T₂ (Irrigation at vegetative (40-50 DAS), tasseling (75-80 DAS) and grain filling (110-120 DAS) stages with fresh water). However, some of the yield parameters, such as number of plant/ m², cob length, cob diameter, as well as straw yield were found maximum in treatment consists of irrigation at vegetative (40-50 DAS) stage with fresh water and irrigation at tasseling (75-80 DAS) and grain filling stages (110-120 DAS) with saline canal water (T₄). Although grain yield was maximum in T₂ (8.01 t/ha), its second highest value was obtained in T₄. Again, the yield values were reduced as the number of irrigation reduced and/or saline water was applied in early crop stage. The obtained results for both mustard and maize clearly indicates that the moderately saline canal water can be a very handy source of irrigation water for rabi crops, when fresh water is relatively scarce. Instead of reducing the number of irrigation events, freshwater irrigation at sensitive stages combined with saline canal water irrigation at later stages can minimize yield loss for moderately saline tolerant crop varieties. However, similar studies need to be continued to observe the long run effect of saline water irrigation in soil profile.

Screening of summer chilli variety/line against water-logging: The study was conducted at Irrigation and Water Management research field, BARI, Gazipur during summer season in 2015 to screen out water-logged tolerant chilli variety/line and to find out the

critical stages of summer chilli to water-logged condition. A factorial field experiment was carried out as a randomized complete block design with eight treatments replicated thrice. The treatments were consisted of two durations of water-logged levels of I₁ (8 hours) and I₂ (12 hours) at flowering and fruit setting stages of summer chilli. Four varieties/lines were V₁: BARI Morich-1, V₂: BARI Morich-2, L₁: C-517 and L₂: C-590. The results showed that the summer chilli plant was found more sensitive to water-logging at flowering stage (34 days after planting). Among the varieties and lines, the line L₁ (C-517) produced better fruit yield while the variety V₂ (BARI Morich-2) produced significantly the lowest fruit yield when water-logged level was I₁ (8 hours) and I₂ (12 hours). The marketable fruit yield was obtained nearly similar in L₁ (C-517) and V₁ (BARI Morich-1) by around 565.8, 432.5 kg/ha and 669.6, 675.4 kg/ha, respectively while the significantly lowest yield was obtained by 256.2 kg/ha and 264.5 kg/ha from V₂ (BARI Morich-2) when water-logged level was I₁ (8 hours) and I₂ (12 hours), respectively. However, the line L₁ (C-517) showed better performance than other the varieties and lines.

Study on properties of Pabna sugar mill's effluent water: In order to judge the suitability of sugar mill's wastewater for irrigation, laboratory experiments were designed and conducted to evaluate the important properties of Pabna Sugar Mill's (PBSM) wastewater. The properties of wastewater samples collected from wastewater disposal canal of the PBSM during different times of crushing season and one sample of freshwater from a hand tubewell at the PBSM complex were determined in the laboratory. The electrical conductivity (EC) of PBSM's wastewater ranged from 1.0 dS/m to 1.2 dS/m and its pH varied from 6.5 to 7.2 (Table 3.1). These wastewater samples were richer than freshwater in terms of nitrogen (14.5–25 mg/l) and phosphorous (6–7 mg/l) content. Iron (0.39–0.45 mg/l), manganese (0.5–0.6 mg/l) and boron (0.3–0.4 mg/l) concentrations were higher in wastewater than in freshwater. Biological oxygen demand (BOD) and chemical oxygen demand (COD) of the wastewater ranged from 120 to 430 mg/l and 250 to 835 mg/l respectively. Temperature of wastewater was 40 °C. The EC, BOD, COD, temperature and manganese contents of wastewater exceeded the threshold values for irrigation and, therefore, the wastewater was not suitable for irrigation without treatment. After primary treatment like cooling and mixing with fresh water, sugar mills' wastewater can be used for irrigation purpose. Thus the wastewater will be a source of

irrigation water which supplies nutrients to crops and it is environmental friendly.

1.3 Postharvest Technology of Crops

Storage stability of processed ginger paste: The effect of salt and packaging materials of the ginger paste were investigated to determine the quality and storage stability of the products during stored at 25°C condition for four months. There were ten treatments combination using two different packaging materials and five salt concentrations. The experiments were conducted two years and the products were analyzed for four months. The acidity contents of the processed ginger paste were decreased and p^H contents were increased after increased the storage life of the products within different salt percentages. The paste was kept and stored up to 4 months in glass container gives little changed in TSS and dry matter percentages. The intensity of light yellow color of the ginger paste were gradually increased with extend the storage period and turned yellow as evidence by increasing values of lightness and changing values of chroma and hue angle accordingly. The ginger paste treated with salt, pour in glass container and stored at 25°C had no presence of bacteria up to 4 months.

Effect of drying on postharvest quality of jute leaf:

The study was conducted to find the effect of drying on postharvest quality of jute leaf. To investigate the performance of cabinet and freeze dried jute leaf powder during storage in polyethylene packets for long time. There were four treatments at various temperatures as 45°C, 55°C, 65°C and freeze drying conditions. The chemical compositions of the fresh and dried jute leaf were analyzed for the year of 2015-2016. The dry matter percentages were gradually decreased for increasing temperature. The TSS content of dried leaf was decreased after increased temperature and prolongs storage. The pH was observed increasing after increasing storage duration as well increasing up to 55°C then decreased after increasing more temperature whereas freeze dried leaf gives highest p^H values. However, the acidity content of dried jute leaf shows inverse relation with p^H. On the other hand, the Vitamin C and β-carotene contents were decreased with increasing temperature for cabinet dried jute leaf. But in freeze dried product gives best results. Accordingly, the intensity of light blue green color of the jute leaf were gradually increased with extend the temperature period and turned blue green as evidence by increasing values of lightness and the changing values of color co-ordinates. Therefore, the study results showed that the

jute leaf dried at 45°C temperature in the cabinet dryer as well as freeze dried powder were stored well in polyethylene packet at ambient condition for prolonged storage.

Effect of blanching on the quality and storage stability of pea:

The influences of blanching on the peas were investigated to determine the quality and shelf life of the frozen pea during storage in deep freeze for four months. There were five treatments using four different blanching times as 1 min, 3min, 5 min, and 7 min with fixed temperature of 80°C. The chemical compositions of the frozen products analyzed for the year of 2015-2016. The dry matter percentages were slightly decreased over storage period. The acidity contents of blanching peas were slightly decreased and P^H contents slightly increased during storage. The Vitamin C and β-carotene contents were decreased after increasing the blanching time. Peroxidase and catalase inactivation time of enzyme for blanching of peas represents the most enzymes were inactivated rapidly as temperature rises to 80°C using 7 min blanching time. Therefore, the study results showed that the frozen peas were stored well in home freeze up to three months using blanching temperature of 80°C and duration of 7 minutes.

Effect of chitosan coating on the quality and shelf life of papaya:

The experiment was conducted to standardization of chitosan coating on papaya during storage at ambient temperature at 38°C and investigated the quality and shelf life of papaya. There were five treatments using four different percentages of chitosan solution with one controlled. The physico-chemical compositions the papaya were analyzed for the year of 2015-2016. The weight loss was gradually increased in increasing storage duration but after full color development increasing rate was less using 2% chitosan coating in papaya. The papaya firmness and acidity contents were slightly decreased whereas the TSS, p^H, vitamin C, and β-carotene contents were increased with the increases storage period. Two percent chitosan coating showed better after 18 days' of storage. Furthermore, the external color parameters also give the best results using 2% chitosan coating for 18 days' storage time. Therefore, the study results showed that the papaya was stored well in plastic crates using 2% chitosan coating for 18-day storage at ambient condition.

Effect of vapor heat treatment on postharvest quality of tomato at ambient condition:

The

experiment was carried out at Postharvest Technology Laboratory, Postharvest Technology Division, BARI, Joydebpur, Gazipur during 19 March to 02 April, 2015 to study the effect of vapor heat sterilization on self life and decay control of BARI Tomato 14. There were twelve treatment combinations comprising three maturity stages full ripened, half ripened and matured green tomato at 55⁰ C vapor heat of 5, 10 and 15 minutes durations and with nontreated. Acidity and vitamin C content significantly reduce during heating but very few differences observed at the end of 10 and 13 days of storage at 33⁰ C ambient condition and total soluble solids and pH did not affected by the heating. Vapor heat effectively controlled weight loss and shrinkage of tomato, best performance observed in case of matured green tomato. Postharvest pathogenic activities were suppressed due to vapor heat treatment, so infection and rot slowed down. For that marketability and shelf life of tomato increased.

Standardization of sweet potato powder for soup:

The study was undertaken to standardization of sweet potato powder for soup preparation. For the time being, investigation was done for the changes of physico-chemical quality parameters and external color of sweet potato as fresh and dried powder with and without blanched condition although the ultimate target was soup preparation. The blanching was done and the potato powder gave the less values both of physico-chemical quality parameters and external color as compared to the without blanched powder. The intensity of light yellow color of the without blanched fresh sweet potato powder were gradually increased with blanching high temperature and turned light orange as evidence by increasing values of L with changing values of C and H accordingly.

Effect of vapor heat treatment on the postharvest quality of tomato at ambient condition: The experiment was carried out at Postharvest Technology Laboratory, Postharvest Technology Division, BARI, Joydebpur, Gazipur during 29 February 15 March, 2016 to study the effect of vapor heat treatment on self life and decay control of BARI Tomato 15. There were two treatment combinations comprising three maturity stages red, turning and matured green tomato at 55⁰ C vapor heat of 5 minutes duration and with non treated. Total acidity and vitamin C content significantly reduce during heating but very little differences observed at the end of 5, 10 and 14 days of storage at 33⁰ C with 75 % RH ambient condition and the best performance observed in case of matured green tomato. Postharvest

pathogenic activities were suppressed due to vapor heat treatment, so infection and rot slowed down. For that marketability and shelf life of tomato increased.

Effect of packaging technique on the quality and shelf life of bitter gourd: The experiment was conducted to evaluate the effect of packaging technique on the quality and shelf life of bitter gourd (*Momordica charantia* L.) using passive modification of modified atmosphere packaging system. The modified atmosphere was created by making perforation in the polypropylene packets. Bitter gourd packaging in 1.5% perforated polypropylene packet resulted substantial reduction in losses due to weight loss and rotting/decay. These treatment combinations also considerably retained vitamin C and β -carotene content. Under this condition the retention of quality and shelf life of bitter gourd could be extended up to 2 days more at ambient condition as compared to vegetables kept without packaging.

Effect of chlorination and wrapping technique on the quality and shelf-life of guava:

The experiment was conducted to evaluate the effect of wrapping materials on the quality and shelf life of guava using different wrapping materials. The wrapping techniques used were cling wrap packets with or without tissue paper or newspaper covering. Guava fruits pre-treated with chlorine water, transporting in plastic crates and then packaging in cling wrap was found effective for quality and shelf life more than 12 days of storage at ambient conditions considering its physical appearance, marketable quality and change of physico-chemical parameters. Beyond this storage period, rotting and decay of the fruits occurs rapidly, turn into faster softening and ripening, and hence lose marketable quality.

Determination of Formaldehyde in Selected Fruits and Vegetables:

The experiment was conducted to detect naturally produced formaldehyde in fruits and vegetables based on spectrometric analysis. Some common fruits like mango, litchi, jackfruit, latkan, blackberry, papaya and vegetables like carrot, okra, long yard bean, snake gourd, brinjal, teasle gourd, pumpkin, wax gourd was tested to estimate the amount of formaldehyde which was produced naturally. Naturally occurring formaldehyde was detected higher in ripe stage than that of over ripe stage in both mango and litchi . Other fruits like jackfruit produced 0.414ppm, latkan 5.458ppm, blackberry 1.893ppm and papaya 1.921ppm formaldehyde naturally at ripe stage. In vegetables like okra, brinjal and tassel gourd formaldehyde was not

detected. Higher amount of formaldehyde (17.069ppm) was detected in imported onion (from India).

Osmotic dehydration of green chili: The experiment was conducted at Spices Research Center, Shibgonj, Bogra to study the drying behavior of green chilli by osmotic dehydration (OD) and /or combined OD and air drying and development of dehydrated green chilli products. Different salt solution such as 5,10,15,20 and 25% were used to conduct OD. The rate of extent of weight loss (WL), moisture content, solid gained (SG), total solid (TS) and normalized solid content (NSC) were strongly influenced by strength of osmotic solution, immersion time and were rapid during the first 8-10 hrs of osmotic dehydration. It is seen that as the solution temperature increases, the moisture content at any given time decreases. In other words, the rate of mass transfer increases with the increase in temperature. Thus %WL, %SG, %TS and NSC increased with increasing temperature. Osmotic dehydrated chillies were dried in room, sun and oven and stored in plastic container (PC) and HDPE at room temperature (RT). It is observed that green chilli treated with 5-25% salt solution followed by sun/oven drying stored PC /HDPE were acceptable up to 1 year while for room/laboratory drying the chilli should be treated with 15-25% salt solution.

Effect of different pretreatments on quality attributes of dehydrated green chili powder: A study was conducted to prepare green chilli powder using low cost processing technique and to study the physiochemical characteristics of green chillies powder. Chillies were treated with 1% AA, 0.3% NaMS, 0.3% NaMS + 1% CaCl₂ solution after blanching 3 and 6 min. and dried in 50°C and 60°C. Sun dried without blanching sample also introduced as another treatment. The results revealed that initial vitamin C and β-carotene in green chilli were 110 mg/100g and 40 μg/gm. On the other hand, the processed green chilli powder showed vitamin C and β-carotene content were 44.50 to 277.35 mg/100 g (dry weight basis) and 95.3-108.450 μg/gm. For colour measurement the L*, a* and b* values in maximum treatments of green chilli powder were near about 18.0-25.0, 1.0-3.0 and 20.0-25.0. After conducting organoleptic taste test of different treated and untreated green chilli powder packed in HDPE bag/plastic bouem and stored at RT, the results for colour, smell, pungency and overall acceptability of 19 samples showed that 3 min blanching green chilli and 3 min blanching green chilli treated with 0.3%NaMS +1% CaCl₂ and dried in 50° C dried

powder found best among other treated and untreated sample. In order to determine the suitability of those powder in a curry, it was decided to conduct organoleptic taste test of beef curry using above 3 samples with ripe chilli powder (collected from market). It is concluded that sample S₄ (3min blanching and treated with 0.3% NaMS and 1% CaCl₂ and dried in 50°C) are undoubtedly the best samples (among the samples tasted) since this sample secured the highest scores in most cases for all quality attributes (except texture, flavour) and was equally acceptable at 5% level and Samples S₄ however ranked between as like very much and like moderately. Though statically all the samples were equally acceptable but there were little bit differences in score among each attributes.

Effect of edible coating on postharvest quality of bell pepper: Bell pepper (*Capsicum annuum* L.) was coated either with chitosan (1.5% and 2% solution) or Aloe vera (AV) gel and coating was air dried. Coated peppers were kept into paper carton and stored in ambient condition (25±2°C and 55±5% RH). The success of coating in retaining postharvest quality of bell pepper was evaluated by determining respiration rate, ethylene production, firmness, weight loss, external colour change, β-carotene content, ascorbic acid content, TSS, P^H, fungal decay and sensory quality. The incidence of rot started on 6th day in uncoated bell pepper. Fruits coated with 1.5% and 2% chitosan affected by microbial decay on 9th day of storage. On the other hand, rot incidence was initiated in 2% chitosan and AV gel coated bell pepper on 12th day of storage. AV gel or chitosan coating reduced respiration rate, weight loss, decay and preserved colours, firmness, ascorbic acid content and other quality parameters thus delaying the progress of fruit decay due to senescence or microbial attack.

Postharvest quality of lemon influenced by coating, packaging and storage condition: An experiment was conducted to assess the influence of Aloe vera gel coating, modified atmospheric packaging (MAP) and coolbot storage on postharvest quality of seedless lemon. Sorted fruits were washed; fruit surface water was removed and then coated with 100% Aloe vera gel when applicable. After coating, fruit surface was air dried and kept in MAP or crates and stored at ambient condition (24±3°C and 50±5% RH) or coolbot (12±1°C and 83±3% RH). Weight loss, respiration rate, ethylene production rate, firmness, decay incidence, TSS, p^H, ascorbic acid content, and also organoleptic attributes were analyzed periodically during storage. The results

revealed that MAP had immense effect on the reduction of the weight loss, shrivelling and preserved firmness throughout the storage. Whereas Aloe vera gel coating mainly helps to retain green colour and control disease incidence of lemon in MAP. Coolbot storage is good to preserve all postharvest quality of seedless lemon for longer period of storage.

Soils, NRM

Project development/Project financing:

A coordinated project entitled *Sustainable Nutrient Management (SUNUM) for Diversified Cropping in Bangladesh* is being developed with involvement of national and international partners, which will be coordinated by an Australian University, The Murdoch University, Bangladesh campus. The project development activities started early this year. BARC is supposed to work as Co-Coordinator of the project. Chief Scientific Officer (Soils), BARC has been proposed as the Co-Coordinator. It will be a four-year duration project since 30 June 2017 through 29 June 2021 with national and international funding by KGF (Krishi Gobeshana Foundation) and ACIAR (Australian Centre for International Agricultural Research). Concept note of the project has already been approved by ACIAR. Following organizations have been proposed as BAU – Bangladesh Agricultural University: Co-Investigator

- KU – Khulna University: Co-Investigator
- PSTU – Patuakhali Science and Technology University: Co- the project partners:
- MU – Murdoch University: Coordinator
- BARC – Bangladesh Agricultural Research Council: Co-Coordinator
- BARI – Bangladesh Agricultural Research Institute: Principal Investigator
- BRRI – Bangladesh Rice Research Institute: Principal Investigator
- SRDI – Soil Resource Development Institute: Co-Investigator
- Investigator
- Fertiliser and biowaste processing companies e.g. ACI Ltd.

Attended a workshop on Strengthening the capacity of satellite based flood forecasting using near real-time JASON-2 Satellite Altimeter Data organized by Institute of Water Modelling, Mohakhali, Dhaka during 28 July 2015.

- Fertiliser policy agencies ; IFDC- International Fertiliser Development Centre,
- IPNI – International Plant Nutrition Institute (yet to confirm)
- BCASPA - Bangladesh Conservation Agriculture Service Providers Association
- ACIAR- Australian Centre for International Agricultural Research: **Funding agency**
- KGF – Krishi Gobeshona Foundation: **Funding agency**

Policy level contribution

Scientists of Soils Unit provided comments on different policy issues to the Ministry of Agriculture as and when received from the Ministry, which are as follows:

- mvi (e`e`vcbv) AvBb, 2006 nvjbmV`KiY wel†q gZvgZ
- “Mycoremediation” Gi †iwR†÷‡kb wel†q gZvgZ
- “G†gvwbqvg bvB†U‡U wewagvjv-2016Ó Gi Lmov PzovšÍKi†Yi Dci gZvgZ
- Meat and Bone Meal ^Re mvi wnmv†e e`envi wel†q gZvgZ
- United Nations Convention to combat desertification (UNCCD) Gi AvlZvq cÖYxZ National Action Program (NAP) Gi Dci gZvgZ
- Lmov ^Re K...wl bxwZgvjvi Dci gZvgZ
- ^v`” Dbœeqb mviPvR© e`e`vcbv bxwZ 2016 Gi Dci gZvgZ
- evsjv††k †eviY gwwkÖZ NPK mvi Ges †eviY gwwkÖZ MoP mvi e`envi l g`j` wba@viY wel†q gZvgZ

Research Management/Financial Management and Coordination

Soils Unit of BARC reviews the soils and fertilizer management research programs of different NARS institutes in the “Research Review and Planning Workshop of Soils Program of NARS Institutes” regularly every. The programs are improved with suggestions by the concerned experts. Necessary guidelines are also suggested to implement the programs.

Monitoring, Reviewing and Evaluation of

Programs/Activities of NARS Institutes

Soils Unit of BARC conducts “Research Review and Planning Workshop of Soils Program of NARS Institutes” regularly every year in which research activities conducted during the last year and proposed research programs for the next are reviewed. Concerned scientists from all the NARS institutes, senior scientists, university teachers,

DAE personnel and representatives from international organizations are invited in the workshop. Suggestions/recommendations from the workshop are incorporated in the reports and programs. The scientists of Soils Unit also participate in the Research Review and Program Planning Workshops on soils programs of different NARS institutes and monitor the research programs during execution. Necessary suggestions and guidelines are provided during monitoring for proper implementation of the programs.

Transferable Technology (Highlights of technology released during the reporting period)

A number of technologies related to soil fertility and fertilizer management have been developed in different NARS institutes. Scientists of Soils Unit, BARC were closely associated with the NARS scientists in developing those technologies. Below is list of the technologies developed during the period:

Sl. No.	Technology	Brief description of the technology	Concerned Division/ Institute
1	25% higher doses of NPK in mustard increases productivity of Mustard-Mungbean-T. aus - T. aman cropping pattern	100% STB ¹ + 25% NPK for mustard, 20 kg N ha ⁻¹ for mungbean and 100% STB fertilizer rates for the T. Aus and T. Aman rice was found optimum for maximizing productivity of the Mustard-Mungbean-T.aus-T.aman pattern in at Gray Terrace Soil of Gazipur	SSD, BARI
2	Vermi-compost improves cabbage yield and soil health	100% RDCF ² (N ₂₄₀ P ₃₅ K ₆₀ S ₃₀ B ₁ kg ha ⁻¹) + vermicompost @ 1.5 t ha ⁻¹ produced highest yield of cabbage in Gray Terrace Soil of Gazipur, Tista Meander Soil of Rangpur and High Ganges Floodplain Soil of Jessore.	SSD, BARI
3	Improvement of soil fertility and yield of Cauliflower-Amaranth-T. aman cropping pattern through integrated nutrient management (INM)	3 t ha ⁻¹ PM ³ with N ₁₂₂ K ₂₀ B _{1.37} kg ha ⁻¹ for cauliflower, N ₁₃₉ kg ha ⁻¹ for amaranth and, 3 t ha ⁻¹ PM + N ₁₀₂ B _{0.88} kg ha ⁻¹ for T. Aman was found best fertilizer package for the pattern in Tista Mender Floodplain soil of Bogra.	SSD, BARI
4	Improvement of soil fertility and yield of Maize-Mung bean-T. aman rice cropping pattern through integrated nutrient management (INM)	3 t ha ⁻¹ PM with N ₂₄₉ K ₇₄ S _{60.5} B _{0.41} kg ha ⁻¹ for maize, 20 kg N ha ⁻¹ for mung bean and, 3 t ha ⁻¹ PM + N ₁₀₁ K _{4.6} S _{B1.1} kg ha ⁻¹ for T. Aman was found best fertilizer package for the pattern in Gray Terrace Soil of Gazipur.	SSD, BARI
5	Improvement of productivity and quality of onion through integrated nutrient management (INM)	Integrated use of cowdung 5 t ha ⁻¹ or poultry litter 3 t ha ⁻¹ or vermicompost 5 t ha ⁻¹ with 100% STB based chemical fertilizer was found best fertilizer package for Onion in Gray Terrace Soil of Gazipur.	SSD, BARI
6	Improvement of the yield	Integrated use of PM Slurry at the rate of 3 t ha ⁻¹ with 75%	SSD, BARI

Sl. No.	Technology	Brief description of the technology	Concerned Division/Institute
	and quality of sweet pepper through integrated nutrient management (INM)	RD ($N_{87}P_{52.5}K_{94}S_{15}Zn_{1.5}$ kg ha ⁻¹) was found as the best combinations in respect of sweet pepper yield and enrichment of soil organic matter. This fertilizer package can reduce 25% of chemical fertilizer.	
7	Reduction of arsenic availability in soils and arsenic uptake by crop plants through phosphorus application	Phosphorus application was found to reduce arsenic availability in soils and arsenic uptake by rice and maize crops.	SSD, BARI
8	Reclamation of heavy metal polluted (by industrial effluents) soils through organic amendments	Application of plant originated organic materials (water hyacinth dust, fern dust, mustard stover dust and barnyard grass dust) was found to immobilize metals in soil and decreased the metal content in plants. On the other hand, animal excreta (cow manure dust, poultry manure dust and vermicompost) had significant impact on phytoextraction of metal from soil.	SSD, BARI
9	Increasing productivity of Potato-Maize-T. aman rice cropping pattern through zinc and boron application	Application of zinc and boron at the rate of $Zn_4 B_2$ kg ha ⁻¹ along with recommended dose of $N_{170}P_{50}K_{135}S_{20}Mg_{10}$ kg ha ⁻¹ & cow dung 5 t ha ⁻¹ was found to maximize the yield of Potato-Maize-T. Aman cropping pattern in Tista Meander Floodplain soil of Bogra (AEZ 3).	SSD, BARI
10	Yield improvement with lower cost of by foliar application of molybdenum in cauliflower	Foliar application of molybdenum @ 0.05% was found to improve the yield and lower the cost of production of cauliflower in acidic soil (AEZ-28).	SSD, BARI
11	Yield improvement of groundnut through boron fertilization in High Ganges River Floodplain Soils.	2 kg B ha ⁻¹ with the recommended dose of $N_{12}P_{32}K_{42}S_{54}Zn_2$ kg ha ⁻¹ was found to maximize yield of groundnut in High Ganges River Floodplain Soils of Ishurdi (AEZ-11).	SSD, BARI
12	Yield improvement of blackgram through boron fertilization in High Ganges River Floodplain Soils.	2 kg B ha ⁻¹ with the recommended dose of $N_{20}P_{20}K_{35}S_{20}Zn_2$ kg ha ⁻¹ was found to maximize yield of blackgram in High Ganges River Floodplain Soils of Ishurdi (AEZ-11).	SSD, BARI
13	Yield improvement of fieldpea through zinc and boron application	Combined application of $Zn_{3.0}B_{1.5}$ kg ha ⁻¹ at Madaripur and $Zn_{3.0}B_{2.0}$ kg ha ⁻¹ at Gazipur and Jessore was found optimum for higher yield and economic benefit of fieldpea cultivation	PRC, BARI
14	Yield improvement of lentil through zinc and boron application in calcareous and terrace soils	$Zn_{2.0}B_{1.5}$ kg ha ⁻¹ along with $N_{15} P_{20} K_{30} S_{10}$ kg ha ⁻¹ was found to produce higher yield and economic benefit of lentil cultivation in calcareous and terrace soils.	PRC, BARI
15	Stage wise crop coefficient values of wheat (cv. BARI Gom-26) for the estimation of water requirement and increased water use efficiency	Crop co-efficient (Kc) values at initial, development, mid-season and late season stages of wheat found to be 0.36, 0.91, 1.10, and 0.12, respectively. Using these Kc values and local evapotranspiration from climatic data the irrigation water requirement of wheat could be estimated, which would increase water use efficiency and maximize yield of the crop, reduce the cultivation cost and useful in saving water resource.	SSD, BARI
16	Improvement of yield and	85 % recommended dose of N as USG with 1 kg B and 0.8 kg	HRC, BARI

Sl. No.	Technology	Brief description of the technology	Concerned Division/Institute
	quality of cauliflower through boron and molybdenum fertilization along with 85% of N through USG	Mo with recommended doses of other fertilizer @ $N_{119}P_{50}K_{90}S_{30}Zn_4B_1Mo_{0.8}$ kg/ha could be suggested as a recommendation for quality cauliflower production.	
17	Reduction of N dose in bitter gourd production through use of USG	70% recommended dose of N as USG along with other fertilizers @ $P_{40}K_{80}S_{30}Zn_4B_2$ kg/ha was found to produce higher yield and economic benefit of bitter gourd.	HRC, BARI
18	Quality banana production by using 85% recommended dose of N through USG along with cow dung @ 5 ton/ha and other chemical fertilizers	cow dung @ 5 ton/ha with 85% recommended dose of N through USG along with other recommended fertilizer doses @ $N_{195}P_{80}K_{300}S_{36}Zn_{1.6}B_{0.4}$ g plant ⁻¹) was found to produce good quality banana	HRC, BARI
19	Fertilizer and water management for chilli in the coastal ecosystem of Bhola	Soil test based fertilizer dose for HYG (FRG-2012) + three irrigations at 25, 40 and 60 DAT was found to produce the highest yield and economic benefits of chilli.	OFRD, BARI
20	Planting technique and fertilizer management on cowpea in the coastal ecosystem of Bhola	The highest cowpea yield and economic benefit was obtained with recommended fertilizer dose (FRG 2012) and spacing spacing (40 cm × 10 cm)	OFRD, BARI
21	Yield improvement of hybrid maize through boron fertilization	2.5 kg ha ⁻¹ B along with 100% NPKSZn and cowdung 5 t ha ⁻¹ produced the highest yield of hybrid maize	OFRD, BARI
22	Yield improvement of turmeric through liming in Mymensingh region	Liming (@ 2.0 t ha ⁻¹) was found to produce higher yield and economic return from turmeric in acidic soils of Mymensingh region.	OFRD, BARI
23	Fertilizer recommendation for lentil + mustard-B.aus rice-black gram cropping pattern in the charlands under AEZ-11	Soil test based (STB) 100% N-P-K-S-Zn + 25% additional NPK was found to produce higher yield of crops in lentil+Mustard-B.Aus.-Blackgram cropping pattern in charland of Pabna.	OFRD, BARI
24	Vermicompost along with chemical fertilizers produced the highest yield of tomato	Vermicompost @ 1.5 t ha ⁻¹ + ² / ₃ rd of recommended chemical fertilizers was found to produce the highest yield and economic benefit of tomato.	OFRD, BARI
25	Controlling cracking of sugarcane by foliar application of boron in Chittagong Hill Tracts	Foliar application of boron at the rate of 1.5 gl ⁻¹ in three equal splits in chewing sugarcane was found to produce higher yield with minimum cracking of chewing cane in Chittagong Hill Tracts.	SND, BSRI
26	Yield improvement of T. aman rice and summer mungbean through integrated use of S, Zn and B in Tista Meander Floodplain (AEZ-3) (Mithapukur, Rangpur) soils	Integrated use of S, Zn and B @ 20, 2 and 1 kg ha ⁻¹ with recommended N, P, K increased T. aman rice yield (4.2 to 5.7 t ha ⁻¹) by 21.8-36.9% and summer mungbean yield (860 to 1076 kg ha ⁻¹) by 15-25% in Tista Meander Floodplain (AEZ-3) (Mithapukur, Rangpur) soils.	SSD, BINA
27	Yield improvement of wheat through integrated	Integrated use of Zn and B @ 2 and 1 kg ha ⁻¹ respectively with recommended N, P, K, increased wheat yield 3.19 to 4.08 t ha ⁻¹	SSD, BINA

Sl. No.	Technology	Brief description of the technology	Concerned Division/ Institute
	use of Zn and B in calcareous soils at Ishurdi	¹ (9.47-24.56 %) in calcareous soil at Ishurdi.	

¹STB: Soil test base fertilizer dose; RDCF²: Recommended dose of chemical fertilizer; PM³: Poultry manure;

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

Policy Level Contribution

Different policy oriented comments were sent to the Ministry of Agriculture according to their needs/requirements. Some of those are as follows:

- (i) Comments on the “Consumer Rights Protection Act, 2009 (draft)”
- (ii) Comments on the “Comprehensive Trade Policy (draft)”.
- (iii) Inputs for making English version of Bangladesh Economic Review 2015
- (iv) Prepared a draft article entitled “Enabling Food for All” for publishing in a Handbook of the 5th Global Economic Summit at Mumbai jointly organized by World Trade Centre and All India Association of Industries.
- (v) Comments on the draft Agreement of Completion Point (ACP) proposed by IFAD under Bangladesh Country Programme Evaluation.
- (vi) Prepared a draft Country Paper in respect of the participation of the hon’ble minister for agriculture on “Food and Nutritional Security in Bangladesh” for the programme launched ‘Compact-2025’- celebrating the 40th Anniversary of IFPRI at Washington DC, USA.
- (vii) Prepared a draft Speech for the hon’ble minister for agriculture in respect of the participation of the programme launched ‘Compact-2025’- celebrating the 40th Anniversary of IFPRI at Washington DC, USA.
- (viii) Comments on the Concept Paper for implementing the workshop proposed by Bhutan in order to expand agricultural trade and investment among BIMSTEC member countries.
- (ix) Inputs for preparing draft report by the ministry of foreign affairs on International

Covenant on Economic, Social & Cultural Rights (ICESCR).

- (x) Comments on the Concept Paper for agricultural cooperation among BIMSTEC member countries proposed by Nepal.
- (xi) Inputs for making Bengali version of Bangladesh Economic Review 2016.
- (xii) Inputs for Budget Speech 2016-17 of Hon’ble Finance Minister.
- (xiii) Comments on Agricultural and Rural Credit Policy and Programme for the FY 2016-17.
- (xiv) Inputs for Business Climate Dialogue between Bangladesh and EU Business Council.
- (xv) Comments on Policies that Influence Women’s Economic Empowerment.
- (xvi) Inputs on G7 Outreach Programme, which was held in Ise-Shima, Japan.
- (xvii) Comments on the draft Agreement on Economic Cooperation between Bangladesh and Bulgaria.
- (xviii) Inputs for discussion with delegations of International Islamic Trade Finance Corporation.
- (xix) Comments on the draft Country Diagnostic Study (CDS) of Bangladesh.
- (xx) Comments on “Bangladesh Jute Research Institute (amended) Act, 2016.
- (xxi) Comments on “National Tobacco Control Policy, 2016 (draft)”.
- (xxii) Comments on the draft report of SDG Data Gap Analysis.
- (xxiii) Inputs on Agricultural Cooperation between Bangladesh and the USA for the 5th Round of Partnership Dialogue.

b. Participation in the Training, Workshop, Seminar, Training-workshop etc (Local):

All personals attended in many Trainings, Workshops, Seminars, Training-workshops etc (Local) organized by different organizations.

1. National and International Linkages

- a. Participation of a *Regional Consultation with CABI's Asia-Pacific Member Countries* organized by CABI South East Asia Regional Centre, Malaysia.
- b. Participation of a "Regional Workshop on Training of Trainers for Official Statistics"- organized by SIAP, Japan.

Highlights of Research Programmes of the NARS institute

Bangladesh Agricultural Research Institute

Agricultural Economics Division

BARI 1

Utilization of Char Land through Pumpkin Cultivation by Using Sandbar Cropping Method in Northern Region of Bangladesh

The study was undertaken to find out the profitability and export potentialities of pumpkin cultivation in Rangpur and Gaibandha district of Bangladesh. A total of 120 pumpkin growers taking 60 farmers from each district were randomly selected for the study. Net return analysis was done on both variable and total cost basis. Domestic resource cost (DRC) analysis was also done for estimating comparative advantage of pumpkin production. The study revealed that net returns were positive for pumpkin cultivation. However, the highest net return was estimated for Rangpur district (Tk105,299/ha) followed by Gaibandha district (Tk93,936/ha). The higher benefit cost ratio (BCR) was also for Rangpur (2.46) followed by Gaibandha (2.40). Bangladesh had comparative advantage for producing pumpkin as the estimates of domestic resource cost (DRC) were less than one. The value of DRC for pumpkin was less than unity, implying that the production of pumpkin would be highly efficient for export promotion.

BARI 2:

Profitability of Betel Leaf Cultivation and its Constraints to Higher Production in Some Selected Areas of Bangladesh

The study was conducted in three betel leaf growing areas namely Noakhali, Rajbari and Khulna district during 2015-16 to assess the agronomic practices, profitability and to explore the constraints to betel leaf cultivation. The findings of the study revealed that betel leaf cultivation was profitable in the study areas, although BCR in the first and second year were below one due to high investment cost and low yield. Highest yield and gross return were received by the farmers in

the fourth year. The benefit cost ratio was found highest in fourth year followed by third year and fifth year. The benefit cost ratio at 12%, 15% and 20% rate of interest were 1.16, 1.15 and 1.14 respectively. IRR was calculated 59% in current situation, IRR 42% was found by 5% decrease of return and IRR 52% by 5% increase of cost. The result indicates that betel leaf cultivation is profitable under changing situation of sensitivity analysis. Farmers faced some constraints like leaf rot disease, high price of borj materials, non-availability of modern variety, low price of betel leaf, high price of oilcake, vine died, lack of capital, etc. Breeders should take initiative for developed high yielding varieties of betel leaf.

BARI 3

Socioeconomic Impacts of Introducing Lentil and Mungbean into Rice-Based Cropping Systems in Western Bangladesh

The study was conducted in eight districts to evaluate the performance of improved technologies at farm level for providing feedback and output of the project. The study analyzed data that were randomly collected from 480 lentil (*Masur*) and mungbean farmers spread over eight project districts. Half of the farmers were selected who cultivated lentil and mungbean under demonstration plot and the rest farmers were treated as control. Due to the efforts of ACIAR project, 64-83% farmers adopted BARI masur-6 variety and 64-70% adopted BARI mung-6 due to their high yielding performance and disease resistant nature. Demo farmers collected improved seed from project source, whereas non-demo farmers mostly purchased seed from market and neighbors. Most demo (52-79%) and non-demo (41-74%) farmers had sown lentil and mungbean seeds at optimum sowing time. Line sowing was followed by 53% demo and 25% non-demo mungbean farmers, which was 25% in the baseline survey. About 51% demo lentil and 60% demo mungbean farmers treated their seed before sowing. All sampled farmers irrigated their crops once a season. Sixty four percent lentil demo and 45% mungbean demo farmers interested to increase pulses cultivation in the next year due to received various benefits. Fifty four percent non-demo lentil and mungbean farmers also wanted to expand pulse cultivation due to lower cultivation cost, higher profit, increase soil fertility, required less time and irrigation. Stress tolerant varieties, small seeded mungbean variety, quality fertilizers, pure pesticides, hand-on training on production practices, fair price of produces, institutional credit facilities, and mechanized harvester for picking mungbean pods with low cost and time

were demanded by the sample farmers in the study areas

BARI 4

Socioeconomic Determinants of Modern Potato Varieties Adoption and Resource Use Efficiency in Northern Bangladesh

This study evaluated the determinants of choosing modern potato variety and its' productivity while allowing for production inefficiency at the level of individual producers. Results revealed that modern variety selection decisions are influenced positively by younger age and gross return from potato and negatively by a rise in the relative price of seed and wage of labour. Stochastic production frontier results revealed that land, labour and irrigation are the significant determinants of modern potato productivity. The mean level of technical efficiency (MTE) is estimated at 82% indicating that farmers can able to increase their yield about 3631kg/ha which is equivalent to Tk41250/ha. Policy implications include measures to increase land reform and keeping potato prices high to boost farm returns and offset the impact of a rise in the labour wage which will synergistically increase the adoption of modern potato as well as farm productivity.

BARI 5

Study of Mandarin Cultivation in Selected Areas of Bangladesh

The study was conducted in three districts namely Panchogor, Bandarban and Moulovibazar to know the production technology of mandarin cultivation, to estimate profitability and identify the constraints of mandarin cultivation. A total of 99 farmers taking 33 from each district were selected randomly. Data were collected through a pre-tested schedule during January-March, 2016. Cost return analysis revealed that mandarin cultivation was profitable in the study areas. The highest cost was estimated Tk. 215293/ha in 16-20th year garden and lowest cost Tk119993/ha in 2-4th year garden. Highest yield was found 16020 kg/ha at 11-15th year garden followed by 13800 kg/ha at 16-20th year garden and lowest yield 11100 kg/ha at 5-10th year garden. The highest gross return was found in Tk. 640800/ha at 11-15th year garden and lowest return was Tk. 444000 at 5-10th year garden. The highest amount of net return was found Tk.435859/ha at 11-15th year garden and lowest return was Tk. 235286 in 5-10th year garden. The benefit cost ratio at 12% rate of interest was 1.68, NPV Tk. 920401 and IRR 30%. Sensitivity analysis implied that mandarin

cultivation is profitable. Scarcity of irrigation in hill areas, acute problem of insect/ pest infestation, lack of improved production technology, poor quality and scarcity of seedlings/ saplings, lack of capital for initial investment and low yield of different varieties were found major constraints for mandarin cultivation in the study areas.

BARI 6

Consequences of Drought in Maize Production in Selected Areas of Bangladesh

The study was conducted in four districts namely Rajshahi, Jhenaidah, Comilla and Rangpur during 2015-2016 to estimate the effect of drought in maize production, technical efficiency and adaptation strategy of maize farmers, and explore related problems of maize cultivation in the study areas. Rajshahi and Jhenaidah were selected as drought prone areas whereas Rangpur and Comilla were selected as favorable environment. A total of 200 farmers taking 50 from each district were selected randomly for the study. Per hectare total cost of maize cultivation in drought prone areas was found Tk. 92,582, whereas in normal environment it was Tk. 79,594. Per hectare average yield in drought prone and normal areas were 7576 kg and 8729kg, respectively. Per hectare net return of maize in drought prone and normal areas were Tk. 28,062 and Tk. 59, 871, respectively. On full cost basis benefit cost ratio (BCR) in drought prone and normal areas were 1.31 and 1.75, respectively. Result of semi-logarithmic regression model indicated that maize production was decreased by 22.4 percent in drought prone areas than normal environment. Loss of yield (70%), loss of plant growth (55%) and problem in flowering stage (43%) were reported to be the major effects of drought. The major adaptation strategies in the drought prone areas were increase number of irrigation (77%), increase amount of fertilizer (42%) and seed (31%) and change of planting date (30%). The coefficient of human labour, seed, chemical fertilizer and insecticides were positively significant in normal environment. However, human labour, irrigation cost and land preparation cost were found positive and significant in drought prone areas. In maize cultivation, the coefficient of experience, education of the farmers and training dummy had positive and significant impact on technical efficiency. Higher price of irrigation (70%), lack of drought tolerant variety (48%) and lack of quality seed (31%) were the major problem in drought prone areas. Again, disease infestation (64%),

lack of quality seed (41%) and high price of seed (36%) were the major problem in normal environment.

BARI 7

Adoption and Profitability of Bari Wheat Varieties in Jamalpur and Sherpur District

The study assessed the level of adoption and profitability of wheat varieties at farm level. Data were collected from 90 randomly selected wheat farmers from Jamalpur and Sherpur districts. The results indicated that BARI Gom 24(Prodip) was highly adopted variety (28%) followed by BARI Gom 26 (21%), BARI Gom 21(Shatabdi) (16%), BARI Gom 25 (13%), BARI Gom 23 (Bijoy) (8%). The adoption levels of ploughing and fertilizer use were low whereas planting time and irrigation were high. Per hectare average total cost producing Prodip was highest (Tk 54211) followed by BARI Gom 25 (Tk 54192), BARI Gom 26 (Tk 51782), Bijoy (Tk 50425) and Shatabdi (Tk 49323) due to the higher cost of human labour, fertilizers and irrigation cost. The yield of Prodip was highest (3.89 t/ha) followed by BARI Gom 26 (3.67 t/ha), BARI Gom 25 (3.37 t/ha), Shatabdi (3.14 t/ha) and Bijoy (3.04 t/ha). Per hectare net return of Prodip was highest (Tk 15169) followed by BARI Gom 26 (Tk. 13858), Shatabdi (Tk 7307), BARI Gom 25 (Tk 6348) and Bijoy (Tk. 4505). Attacks of rat and bird, non- availability of new variety seed at proper time and lack of technical knowledge about improved cultivation practices were the major constraints for the adoption of wheat technologies.

BARI 8

Relative Profitability of Different Cropping Patterns in the Chittagong Region

The study was carried out in three selected villages namely Soabil, Khorna and Mohadebpur under the Upazila's of Fatikchari, Patiya and Sitakonda in Chittagong District, respectively during 2015-16 with mainly to identify the profitable cropping pattern in the region. The highest single cropped area was found at Fatikchari and lowest in the Sitakonda. This might be due to the availability of vegetable production in the Sitakonda area. The highest double cropped area was found in Fatikchari and triple cropped area in Patiya. This might be due to more irrigation facilities were availed in Patiya. It was reported that after the rice cultivation in all locations, the cauliflower (29%), tomato (26%), potato (56%), chilli (40%), bean (70%), brinjal (30%), yard long bean(6%), cucumber (Khira) (67%) and lady's finger(38%) were found as the major

vegetables crops in all locations. About 73.3% farmers cultivated country bean in the selected area of Sitakonda. More than 80% farmers cultivated potato in Patiya. The highest 36.6% farmers cultivated chilli in Fatikchari. In the case of cropping pattern, the highest percentages of the farmers were operated the pattern of i.e. winter vegetables-summer vegetables-T. aman irrespective of all areas followed by winter vegetable-fallow-T.aman and Boro-Fallow-T.aman (Table10). It is mentioned that the winter vegetables were identified as potato, tomato, cauliflower, chilli, radish, brinjal, gourd etc. On the other hand, the summer vegetables were identified as cucumber (Khira), lady's finger, country bean, yard long bean, coriander etc (Table 12.). Among the cropping pattern the highest benefit cost ratio was found in winter vegetables-summer vegetables-T.aman followed by winter vegetables-fallow-T.aman irrespective of all locations. Among the locations, the highest profitability was recorded from winter vegetables-summer vegetables-T.aman in Patiya followed by Sitakonda. Results revealed that the gross return was found as the highest from Boro rice at Tk.57646/ha irrespective of all locations. Age of respondents, education, family size, occupation, income from rice and vegetable cultivation with intercropping system, training and credit received was influenced on household income significantly. The highest 86.6% farmers reported that the highest irrigation cost was the main problem for crop production in all locations followed by low product price (74.4%) and low purity of seeds (61.1%). No farmer's innovation was found in the selected locations. The income from rice and vegetables cultivation (bean in Sitakonda, Sweetgourd & Khira in Fatikchari, Patato in Patiya) significantly contributed in their whole farm household income. If irrigation facilities could be provided, the four crop based cropping pattern such as(i) T.aman-Mustard/potato-Boro-T. aus (ii) T.aman-Mustard-Mungbean-T. aus can be suggested for improving the food security and household income in the region.

BARI 9

Production and Marketing Constraints of Black Gram in Char Land of Jamalpur and Sherpur Districts

The present study is an attempt to assess the present position, existing agronomic practices of black gram cultivation, its profitability and constraints of black gram production. It was conducted in purposively selected two black gram cultivated union in Sherpur and Jamalpur district on the basis of maximum area under this crop. The majority of the farmers had sown

seeds during the last week of September to first week of October. The average seed rate was found to be 19.36 kg per hectare which indicated that all farm households used below recommended dose of seeds (35-40 kg/ha). About 23 and 33 percent of the total variable cost was for human labour in Sherpur and Jamalpur district, respectively. The average yield of black gram was found higher than the national average. The average gross margin was observed to be Tk. 41572 on total variable cost basis. The cost per kilogram of black gram cultivation was Tk. 35 and return from one kilogram of black gram production was Tk. 74. The results revealed that the main constraints faced by black gram grower were lack of irrigation facility, low output price, labour scarcity, lack of proper knowledge about improved varieties, insect pest and diseases management, excessive rainfall after flowering and weak research-extension farmers linkage etc.. Farmers also faced some marketing related problems such as limited buyers, uncertain price, absence of cold storage and high market charge. Farmers cultivated black gram because of higher yield, higher income, and easy growing.

BARI 10

Assessment of Postharvest Losses and Food Quality by Evaluating Postharvest Practices and Marketing Performances in Selected Vegetables Supply Chain in Bangladesh

Different studies assessed quantitative postharvest losses of vegetables based on field surveys, but loss assessment through physical monitoring of vegetable lots is rare in Bangladesh. Therefore, the study was carried out at Jessore, Kishoregonj and Mymensingh districts to estimate quantitative and qualitative postharvest losses of vegetables at various stages of supply chain using conventional, improved and cool chain packaging and transportation, and the financial impact of improved packaging over conventional method during January-April, 2016. Nine lots of vegetables namely, brinjal, country bean, tomato and bitter gourd were monitored using conventional, improved and refrigerated transportation system, and recorded data on postharvest losses and related financial costs for estimating cost-benefit analysis. The study revealed that the postharvest losses of vegetables were much higher for conventional method of packaging compared to improved and cool chain method. In conventional method, the percent of postharvest losses of brinjal, country bean, tomato, and bittergourd at traders' level were 27.2%, 29.5%, 22% and 9.9% respectively. The corresponding losses were

16.4%, 23.1%, 17.7% and 9.2% under improved method, respectively. In cool chain method, the total loss of brinjal was 13.6% which was much lower than other two methods, but the system is not cost effective to the traders. In monetary term, the losses in conventional method ranged from Tk. 924-Tk.1482 per ton for selected vegetables which were 48-312% higher than improved method. In improved method, Bepari and retailers received net margins ranged from Tk.1219-Tk.4632 and Tk.2345-Tk.8866 per ton which were 10.4-42.6% and 3.4-6.0% higher than conventional method respectively. In cool chain method, Bepari received negative net margin (Tk.-2067) in brinjal marketing. The stakeholders gave emphasis on packaging high value vegetables using plastic crates which effectively minimize losses during distant transportation.

BARI 11

A Baseline Survey on Winter Tomato Supply Chain in Selected Areas of Bangladesh

Tomato is a popular and nutritious vegetable in Bangladesh. Due to the lack of appropriate pre- and post-harvest measures and inefficient supply chain, a lot of tomatoes are spoiled every year. Adequate data and information regarding these issues are lacking in Bangladesh. Therefore, the study *assessed the knowledge, attitude and practices (KAP) of key actors in winter tomato supply chains regarding pre- and post-harvest handling, food safety, food quality, and post-harvest losses, and the status of tomato market opportunities in Bangladesh. Sixty farmers and 91 traders in the tomato supply chain were interviewed from Rajshahi, Bogra and Dhaka districts. The results revealed that most farmers (100%) and traders (97-100%) showed positive attitudes towards crop maturity, safe tomato, importance of good packaging, consumers' awareness, and took various pre- and postharvest measures for keeping tomatoes safe for the consumers. The estimated average postharvest losses were 4.57% and 11% at farm and traders' level respectively. At farm level, these losses occurred during sorting & grading (1.24%), transportation (0.95%), harvesting (0.94%), storage (1.03%) and other causes (0.41%). The highest loss was recorded for retailer (4.71%) and the lowest for Faria (1.82%). This study identified seven supply chains for tomato marketing. The longest and prominent channel was Farmer>Bepari>Urban*

Arathdar>Urban Retailer>Urban Consumer. Farmers and *Farias* used different local carriers like bicycle, rickshaw, van, and push cart to transport tomato. Trucks and pick up van were mostly used by *Bepari* to transport tomato from assemble markets to distant wholesale markets. Retailer received the highest net profit (Tk.7,858/ton) due to higher sale price and lower marketing cost followed by *Faria* (Tk.2,444/ton) and *Bepari* (Tk.1,852/ton). Major marketing problems in the supply chain were delayed sale (64.3%), spoilage (61.4%) and lack of buyers (52.9%). Both farmers and traders suggested various measures to reduce postharvest losses and keep tomatoes safe for the consumers.

BARI 12:

A Baseline Survey on Mango Supply Chain in Selected Areas of Bangladesh

A lot of mangoes are spoiled every year due to the lack of proper pre- and postharvest measures and inefficient supply chain. Sufficient data and information on these issues are lacking in Bangladesh. Therefore, the study *assessed the knowledge, attitude and practices (KAP) of key actors in mango supply chains and the status of market opportunities in Bangladesh. A total of 98 respondents taking 30 growers, 53 traders and 15 consumers were interviewed from Chapai Nawabganj and Dhaka districts. The results revealed that all growers (100%) and traders (97-100%) showed positive attitudes towards crop maturity, safe mango, and role of good packaging, and took various pre- and postharvest measures for keeping mangoes safe for the consumers. The estimated average postharvest losses were 14.11% and 9.61% at farm and traders' level respectively. At farm level, these losses occurred during harvesting, sorting & grading, and transportation. Harvesting losses were due to cracking, bruising, compression, and disease and insect damage. The highest loss was recorded at retail level (4.64%) followed by Bepari (3.95%). This study identified eight supply chains for mango marketing. The longest and prominent channel was Farmer>Bepari>Urban Arathdar>Urban Retailer>Urban Consumer. Farmers and Farias used different local carriers, whereas trucks and pick up van were used by Bepari to transport mango from assemble markets to urban wholesale markets. Faria received the highest net margin (Tk.8,068/ton) due to lower marketing cost and spoilage followed by retailer (Tk. 6,601/ton) and*

Bepari (Tk.5,394/ton). Major marketing problems in the supply chain are delayed sale and lack of buyers. Both farmers and traders suggested various measures to reduce postharvest losses and keep mango safe for the consumers.

BARI 13

Accessibility to Super Market Value Chain and Price Variability of Smallholder Vegetable Farmers in Bangladesh

The supply of agricultural products by farmers to super market is a new form of organized modern marketing based on consumer demand. The study was undertaken in three districts namely Narsingdi, Jessore and Dhaka to assess the three different chains in which two were under traditional supply chain and one was under super market value chain for a comparison of different aspect of vegetable marketing like marketing cost, margin, producer's share, Price variability and determinants of farmer's access to super market. Three vegetables namely brinjal, country bean, and tomato were selected for the study. A total of 145 sample consisting 90 farmers 40 traders and 15 consumers were interviewed for the present study. The study was conducted during the period in 2015-16. Data were collected from both primary and secondary sources. The per quintal total marketing cost was found highest for traditional supply chain-II which was Tk.804 for brinjal, Tk.800 for country bean and Tk.779 for tomato whereas it found lowest for super market value chain-III which was Tk.484 for brinjal, Tk.472 for country bean and Tk.520 for tomato incurred by different stakeholders of the respective chain. The per quintal total net value addition was also found highest for traditional supply chain-II and lowest for super market value chain-III. The producer share in consumer price of super market value chain (54%-60%) was higher than the traditional supply chains (42%-58%). Logit regression model revealed that education, motivation of any institution, receiving training and existing sale contact have significant and positive influence on producer decision for accessing any super market. Multiple linear regression models revealed that yield, substitute, transport facility, seasonality, marketing cost and marketing margin have significant and negative relationship with brinjal price which indicated that these factors negatively influences the brinjal price and similar trend was also found in case of country bean and tomato. Friendly environment (100%), safe food (95%), good quality (90%), one stop shopping (100%), lower price (40%) & time savings

(80%) were the consumer perception about super marketing. The rejection of lower grade vegetables and procurement of vegetables according to their indent were the major problems of super marketing.

BARI 14

Marketing System of Summer Tomato in Jessore District

The study was conducted for the assessment of Marketing system of summer tomato in Jessore. Data were collected from 30 randomly selected tomato farmers and 60 traders from Jessore and Dhaka market. Farmer, *faria*, *bepari*, wholesaler, commission agents and retailer were involved in marketing of summer tomato. Marketing cost of farmer, *faria*, *bepari*, wholesaler, retailer(urban) and retailer(rural) were Tk.43 /quintal, Tk.69.10/quintal, Tk.218.35/quintal, Tk.244.27/quintal, Tk.185.67/quintal and Tk.107.35/quintal respectively. Net margin or profit of the *faria*, *bepari*, wholesaler and retailer were Tk.130.00/quintal, Tk.81.65/quintal, Tk.55.73/quintal and Tk.214.33/quintal respectively. There were seven marketing channel identified in tomato marketing.

BARI 15

Assessment of Existing Value Chain of Date Palm in Bangladesh

The study was conducted for the assessment of existing value chain of date palm in Jessore. Data were collected from 30 randomly selected date palm farmers and 60 traders from Jessore, Magura and Jhenaidah. Analysis was done on per quintal (100 litre) raw juice basis. Farmer, processor, *bepari* and retailer were involved in processing and marketing of date palm juice. Total processing cost of date palm molasses was tk. 418.84 and for Patali gur it was tk. 422.31 per 100 litre juice. Marketing cost of farmer cum processor, *Bepari* and Retailer were Tk.29.00/quintal, Tk.26.25/quintal and Tk.21.34 /quintal respectively. From 100 litre of juice it can get 16.67 kg of gur and for patali it was 15 kg. A farmer sell raw juice, molasses *gur*, *patali gur* and by product were Tk.20/litre, Tk.140/kg, Tk.160/kg and Tk.30 respectively by the farmers. Net margin or profit of the processor, *bepari* and retailer was Tk.1552.16 /quintal, Tk.138.75/quintal and Tk.148.66 /quintal of juice respectively. There were six value chain exist in the date palm marketing. Processor, *bepari* and retailer added the value tk. 1552.16, tk. 138.75 and tk. 148.66 respectively to the value chain. Price gap between the consumers and producer was tk. 335 per 100 litre of

juice. As producers and consumer price had less gap thus the producers share was 85.65 percent.

BARI 16

Study on Production and Price Relationship for Chilli in Bangladesh

The study estimated the fluctuation of area, production, yield and price of chilli and determined production-price relationship of chilli in Bangladesh using secondary data (1985-2014) from Bangladesh Bureau of Statistics. Data were analyzed using simplest method for fluctuation, and the Koyck model of distributed lag models. The results revealed that the extent of annual price fluctuation of chilli was between -55 to 111 percent, while the extent of fluctuation of area, production and yield ranged between -39 to 156, -27 to 161 and -17 to 55 percent respectively during the study period. Production swing, climatic condition and lack of storage facilities were the main causes of unstable price of chilli in Bangladesh. For preventing price fluctuation, government price control, improvement of farming and other infrastructures, provision of loan and subsidies, improvement of IT service, improvement of production technology and proper storage system are urgently needed. Again, chilli production in Bangladesh has been influenced by the lag value of average price formed in the market. The most striking result of the study is that the time required for the changes in the chilli prices to have an effect on chilli production is 6.09 years. The value of coefficient indicated that the changes in lag values of the prices had a positive influence on production, this influence was getting smaller. To reduce the risk and uncertainty of the chilli price, sustainable chilli farming and establishment of an efficient marketing organization is a necessity.

BARI 17

International Competitiveness of Selected Pulse Crops in Bangladesh

The study was undertaken to assess the financial and economic profitability of selected pulse crops in Bangladesh. One hundred eighty pulse growers were randomly selected in Rajshahi, Natore and Jessore districts for the study. Net return analysis was done on both variable and total cost basis. Policy Analysis Matrix (PAM) and Domestic Resource Cost (DRC) analysis were also done for estimating comparative advantage of the selected pulse crops. The study

revealed that net returns were positive for all pulse crops. However, the highest net return was estimated for lentil (Tk75,235/ha) followed by chickpea (Tk42,119/ha). Comparatively lowest net returns was found for mungbean (Tk34,435/ha). The highest benefit cost ratio (BCR) was also for lentil (2.07) followed by chickpea (1.64). PAM and DRC analysis showed that Bangladesh had comparative advantage for producing all selected pulse crops as the estimates of domestic resource cost (DRC) were less than one implied that the production of pulse crops would be highly efficient for import substitution.

BARI 18

Climate Variability Stresses, Adaptation and Capacity Assessment of Farmers in Some Selected Coastal Areas of Bangladesh

Climate change and its variability cause different biotic and abiotic stresses that negatively affect on agricultural crops and the livelihoods of coastal farmers. But data and information regarding these issues are scarce in Bangladesh. Therefore, the study was conducted to assess the adaptation knowledge and strategies to cope with climate variability, identify the factors that determine the adaptation capacity of the farmers, and identify potentiality and problem of adaptation to climate variability faced by the farmers. The study revealed that draught and uneven rain (100%) were the severe stresses followed by water salinity (30%), soil salinity (25%), disease infestation (21%) and insect attack (21). The differences of crop yields between adverse climatic condition and national average ranged from 3-78 percent, between normal condition and national average ranged from 1-65 percent, and between adverse climatic condition and normal climatic condition ranged from 40-78 percent. To adapt adverse situation farmers adopt different measures like reserve rain water, digging well, use salt tolerant variety, irrigation, drainage system, use pesticides, use insecticides, and migrate to other occupations on a temporary basis.

BARI 19

Occupational Shifting and Migration from Agriculture to Non Agriculture Sector in Some Selected Coastal Areas of Bangladesh

The study was conducted in three southern districts namely Pirojpur, Jhalokathi and Barisal for the identification of the determinants of agricultural labour migration, social, economic and agricultural impact of labour migration etc. The study revealed that loss in agricultural activities (92%) were the major causes of

labour migration followed by low price of agricultural commodity (86%), low labour wage (68%), high production cost (54%). Maximum farmers migrated outside of own area (55%). Some farmers migrated within own area (32%) and foreign country (13%). Migrants mainly involved in different activities but maximum migrants involved in full time non-agricultural activities outside own area (55 %). Some changes in agricultural pattern were found due to migration, besides migration increased the employment opportunity and hence social status. Age, family members and family income were the major determinants of agricultural labour migration.

BARI 20

Assessment of Training Needs for the Farmers of Bangladesh

Bangladesh Agricultural Research Institute (BARI) conduct a variety of trainings for the benefit of farmers of different crop intensive areas of Bangladesh. Identification of training needs is the most important step in any organizations training programme. The present study on training needs assessment of the farmers was conducted by Training and Communication Wing of BARI. A list of nine (9) major components/ thematic areas was prepared. Under each major component, specific and relevant training needs item were collected and systematically incorporated into an interview schedule and administered in terms of frequency of training imparted. The results revealed that even in the most crop intensive areas, there was an inadequacy of necessary training. Farmers sought maximum trainings on seed production, integrated pest and disease management, bio-control of pests and diseases, soil and water conservation, management of problematic soils and post-harvest technology of vegetables and fruits. Respondents defined identification of adulterated fertilizer, insecticide and pesticide application, disease and insects of mango varieties and fruit bagging system of mango as very good type of training. Lack of markets/information about markets, low prices, high cost of inputs (e.g. fertilizer, seeds), poor or insufficient training, pests and diseases problem scored the highest among the problems that respondents face in their crop production activities. The BARI has to re-orient their trainings based on these findings to reduce the existing technological and adoption gap among the farmers.

Bangladesh Rice Research Institute (BRRI)

Agricultural Economics Division

BRR1 1

Farm Level Adoption and Evaluation of Modern Rice Cultivation in Bangladesh

BRR1 dhan28 and BRR1 dhan29, these two most popular varieties covered about 69% of areas in Boro season. BR11 and BRR1 dhan49 were the most popular varieties in T. Aman season covering 23% of total T. Aman area. In Aus season, the area coverage of BRR1 dhan28 was the highest (21%) followed by BR26 (9%). Among BRR1 varieties, BRR1 dhan29 was the top yielder in Boro (5.81t/ha) followed by BRR1 dhan28 (5.30 t/ha). In T. Aman season, BRR1 dhan49 ranked the top position in terms of per unit yield (4.81 t/ha) followed by BR11 (4.77 t/ha) and BRR1 dhan44 (4.77t/ha). In Aus season, BRR1 dhan29 also produced higher yield (4.04 t/ha) followed by both BRR1 dhan48 (3.93 t/ha). Recently, some Hybrid varieties are being adopted as replacement of other MVs in Boro and Aus seasons due to higher yield performance.

BRR1 2

Domestic Vs Indian Aman Variety Cultivation in Border Region of Bangladesh: A Field Level Investigation

The findings of the study revealed that due to lack of sufficient suitable domestic *Aman* varieties, farmers cultivating Indian varieties in this season. The area coverage of Indian varieties was 57% in 2012-13 which declined to 55% in 2014-15. Unless and until development of suitable domestic varieties for *Aman* season, cultivation of Indian varieties would continue. So, the breeders should consider the agro-climatic conditions of border region and farmers' socio-economic demand in the process of variety development. In this regard, short to medium growth duration, drought resistance, quality rice, higher milling out-turn and market demand should be given due consideration. In addition, demonstration, farmers' training and proper extension services may help to quick dissemination of domestic *Aman* varieties in the border region of Bangladesh.

BRR1 3

Estimation of Costs- Return, Factor and Income Shares of MV Rice Cultivation at Farm Level

Rice farmers are still using more seed than the recommended rate irrespective of cropping seasons.

Although, they used higher dose of Urea, applied comparatively lower amount of MoP fertilizer. Boro growers obtained higher yield due to better cropping environment, good management practices and use of better genotypes. They received comparatively lower amount of gross return from MV Aus and Boro owing to lower market price at harvest time. T. *Aman* growers received higher net return due to better market price. Factor and income share analysis revealed that the human labour contributed the highest effort to the production process; and, on the other hand, farmers earned the highest share of income among all other production participants.

BRR1 4

Technical Efficiency of Rice Production: A Case Study in Dinajpur District

The findings of the study revealed that the paddy production is profitable. *Boro* paddy yielded more and achieved higher net returns than other rice crops, though, the study confirmed that per hectare yield of *Aman* paddy is lower than that of *Boro*. Thus; there is an ample scope to increase *Aman* paddy production in the area by introducing some new modern varieties. The findings of the study also revealed that, yield can significantly be improved without increasing the level of inputs and cost can noticeably be reduced without reducing the current level of outputs. At full technical efficiency, on an average, farmers could reduce input application in *Boro* and *Aman* season around 20% ($[(100 - 83.25)/ 83.25] \times 100$) and 18 % ($[(100 - 85.15)/ 85.15] \times 100$), respectively without reducing yield, simply by improving technical efficiency. Farmer's age, education, training, access to micro-credit, and extension facilities are the important factors causing variations in the levels of technical efficiency.

BRR1 5

Value Chain Analysis of Rice in the Hilly Areas of Bangladesh

The traditional rice value chain was short in both geographical length and involvement of intermediaries. It is the local supply chain of paddy by the subsistent farmer, de-husked in local mills, and consumed by them or sold to the local markets. On the other hand, rural-urban rice value chain was geographically and intermediation long. They sold paddy to local traders who sell it as paddy or milled in local mills. After processing they sold it to rural wholesale markets and

finally to the retailers. Transitional rice value chain consists of Farmer-Miller's Agent-Rice Mill-Wholesaler cum retailer-Consumer, which was geographically long and intermediation by medium, entails the wholesalers of hilly areas buying rice directly from surplus areas. The millers buy paddy through agents directly from farmers and others occasional traders. This is more efficient and effective circuit of value chain in the hilly areas. The rice market structure should be guided to transitional value chain of less intermediaries' actor-involvement. Each of the actor's roles should be valued as per their contribution in value addition.

BRRI 6

Food Habit and Dietary Intake Pattern of Garment Workers at Gazipur Area

The results showed that 12 percent of the respondent was only the earning member of the family. Average family size of the respondents was 7 and dependent family member on his/her income was 3. Most of the respondents belong to farming community (78%). Majority (58 percent) of them were migrated for extreme poverty and insolvency. The findings ensured that cereals, notably rice, constitute the most important food item consumed by the garment workers, which essentially dominated daily food intake per person at 443 gm making up 52.37% of total food consumption. Among the respondents 36 percent took rice thrice a day and rice was also being consumed as snacks in different forms as well. Varietal preference of rice was found dependent on respondent's budget allocation and per unit retail price.

Bangladesh Sugarcane Research Institute (BSRI)

Agricultural Economics Division

BSRI 1

Economic Analysis of Sugarcane and Its Intercrops in Hill Areas of Bangladesh

Average yield of sugarcane in hill area was 39,220 piece/ha and the highest yield was found in Bandarban district (51,242 piece/ha) followed by Khagrachari district (36,778 piece/ha). The highest cost of production and the highest net return was found in Bandarban district Tk.2,79,223/ha and Tk. 5,46,69/ha respectively. Average BCR was 3.08 and the highest BCR obtained in Rangamati 3.31. Farmers cultivate potato, capsicum, tomato, been etc. as intercropped with sugarcane in hill areas. Farmers received higher BCR

(5.48) at Bandarban cultivating Been as intercrop with sugarcane followed by Rangamati (3.46) and Khagrachari (3.20). Human labour, tractor/animal labour, manure & fertilizers' cost and irrigation cost have the positive and significant relation with total return. Ninety percent farmers of hill area supply their cane for chewing purposes and the rest ten percent used for gur production. Three marketing channels were identified in hill areas. Out of them Farmers-Paiker-Aratdar- Retailer-Consumer marketing channels ranks the 1st position and 65% products run through this channel. There are many problems and constraints faced by the hill farmers such as- technical constraints, marketing constraints and social constraints.

BSRI 2

A Study on Production and Marketing of Gur in Selected Areas of Bangladesh.

The comparative study between gur production and selling cane to sugar mill shown that gur production was more profitable than supplying cane to the mill. The farmers are more interested to produce *gur* or sale sugarcane to the *gur* maker. Per hectare yield of sugarcane production in mill zone and non mill zone were 57 and 55 ton respectively. Average sugarcane production cost in mill zone was Tk.1,15,910/ha and total return was Tk. 1,52,703/ha. A farmer when he sales his product then he received more returns (Tk. 1,98,588/ha). Benefit cost ratio achieved from sugar mill and *gur* maker was 1.32 and 1.70 respectively. On the other hand, production cost and total return of a *gur* farmer was Tk.2,19,800/ha and Tk. 3,30,500/ha respectively. Benefit cost ratio of a *gur* farmer was 1.50. The benefit cost ratio of a *gur* maker was 1.38. Production cost of *gur* farmer and *gur* maker is Tk.40.00/kg and Tk. 45/kg respectively. Sugarcane *gur* contains 06%-1.0% minerals, iron(11 mg%), calcium (0.4%), magnesium and phosphorous (0.045%). *Gur* also contains reducing sugars including glucose and fructose (10-15%), protein (0.25%), and fat (0.05%) (Rao *et al.*, 2007). There are many intermediaries in *Gur* marketing (Fig. 1). On the basis of the intermediaries five marketing channel were identified as a dominant. The *Gur* farmer/*Gur* maker - Arratdar/Foria - Paikar - Retailar - Consumer was identified as a most dominant client. About 90% farmers hired van and bi-cycle or rikshaw to carry their *gur* in the market. It can be noticed that the grower's share 66.66% of consumer's price. On the other hand marketing cost, trader's profit and marketing margin shares 8.33%, 25% and 33.33% of the consumer's

price. There was a problem of storage facility. The farmers are not trained to preserve the *gur*. The study suggested to create facility to storage *gur* and established the organization of *gur* board to solve problems of *gur* farmers. There is no institution for *gur* marketing. A *gur* Board can be established for market promotion. It is revealed that rickshaw/van/bullock carts were the major means of transport for carrying *gur*.

Bangladesh Livestock Research Institute

Socioeconomic Research Division

BLRI 1

Value Chain Analysis of Milk and Comparative Advantage of Milk Production in Bangladesh

The study reveals that the production cost of milk for cross-bred cattle was estimated BDT 43,673/ ton where variable cost was BDT 41,381/ ton and fixed cost was BDT 2,291/ton. In variable cost items, human labour occupied the highest (16953/ton). Per ton net return was estimated for cross-bred cattle BDT 2,543. Average gross margin and net margin per 100 liters of milk for milkmen was estimated BDT 5,479 and BDT 969, respectively. In case of sweet seller, average gross margin and net margin per 100 liters of milk (equivalent to 67 kg sweets) were estimated BDT 11,888 and BDT 4,875, respectively. Tea sellers' average gross margin and net margin was also estimated BDT 12,537 and BDT 6,194, respectively in the study areas. Value addition among the milk value chain actors in the selected areas was estimated in this study. It is observed that the all value chain actors i.e. milkmen, sweet seller and tea seller added different types of value. On an average, milkmen added value 29%, sweet seller 150% and tea seller 175%. In the study NPCO value under import parity were found to be greater than one (>1) for fresh milk (cross-bred). This indicates that policies of fresh milk provide nominal protection for the producers. NPCI's values was found to be less than 1 (<1) for fresh milk of import parity price suggesting that the government policy are marginally reducing import cost and average market price of input just keeping the world price. NPCI values of less than 1 (<1) clearly indicate that government has been providing marginal support to the milk sector. In addition, the study also estimated EPC (Effective protection coefficient) which is better indicator of effective incentive than the then NPC, as it finds the impact of production on inputs and outputs, and depicts the degree of protection according to the

value addition process in the production activity. The values of EPC were found to be greater than 1 ($EPC > 1$) for fresh milk (cross-bred), implying that government policies provides positive incentives to the producers. The result of DRC calculation has been done on import parity prices. These depend actually on the tradability status on commodity. The value of the DRC estimation revealed that Bangladesh had a comparative advantage for import substitution of fresh milk as on DRC values were less than 1 (<1). In other words, government policy could save foreign exchange by producing fresh milk domestically and efficiently, it causes import subsidies. This is because the opportunity cost of domestic resources and non-traded inputs use in producing milk is less than ($<$) foreign exchange saved. The SCB (social cost benefit) in less than one, it indicates that the benefit of government policy of protection is the higher than the cost of protection. Estimated profitability is greater than 1 (>1) indicates that the private profit is higher than the social profit. The policy benefits are in favour of producers.

BLRI 2

Economic Evaluation of Buffalo Production in selected regions of Bangladesh

For milking buffalo rearing the cost items involved in the production chain are human labour, feed cost, medicine, vaccination, insemination, various equipments and housing etc. Cash expenditure and imputed value of family supplied inputs were also included in this computation. Human labour was the prime cost factors in milking buffalo rearing in the study areas. Study found that per lactation labour cost was estimated BDT 13913 followed by feed cost was BDT 10063. Per lactation total cost was estimated BDT 24507, whereas variable cost was BDT 24249 and fixed cost was BDT 258 only. It is estimated that average lactation period was 255 days in the areas. And average milk production was estimated 2 litres/ day. The highest return was come from milk production that was BDT 27189. The gross return was estimated BDT 32114 / lactation. The net return was calculated BDT 7865. The BCR was 1.31 (full cost basis) in the study areas.

Bangladesh Institute of Nuclear Agriculture (BINA)

Agricultural Economics Division

BINA 1

Potential productivity and yield gap of Biansoybean-2 in the research station and farm level

The yield performance of Biansoybean-2 is higher than national average. The Biansoybean-2 production in the study areas is profitable. Biansoybean-2 farmers received higher return on their investment. Analysis of resource use efficiency indicates that more profit can be obtained by increasing investment in crop management and application of urea and insecticide for Biansoybean-2 cultivation. Although Biansoybean-2 is a profitable crop, farmers could not harvest expected benefit due to various problems. The quality seed of the existing improved variety should be made available to the farmer for greater extension of this crop. Nevertheless, due efforts should be made to develop disease free and insect tolerant variety for getting higher return from Biansoybean-2 production in near future.

BINA 2

Economic Study of Submergence Tolerant Rice Variety Binadhan-11

The average cost of production of Binadhan-11 is Tk. 40392.28 per hectare. The major share of total cost was human labour, power tiller and fertilizers. The cost of Binadhan-11 cultivation was found higher in Mymensingh (Tk. 41646.89/ha) followed by Sherpur, Jamalpur and Kurigram was Tk. 40970.44, Tk. 39483.90 and Tk. 39467.88 per hectare, respectively. The average yield of Binadhan-11 was 4250.75 kg (4.3 t/ha) per hectare. The gross return of Binadhan-11 cultivation was found higher in Mymensingh (Tk. 81520.53 ha⁻¹) followed by Sherpur, Jamalpur and Kurigram in Tk. 77053.09, Tk. 60050.18 and Tk. 64051.16 per hectare among the study areas. The net returns were Tk. 39873.64, Tk. 36082.65, Tk. 20566.28 and Tk. 24583.28 per hectare followed by Mymensingh, Sherpur, Jamalpur and Kurigram, respectively. In the study area, highest net return was found in Mymensingh district (Tk. 39873.64 per hectare) and lowest in Jamalpur district (Tk. 20566.28 per hectare). The average net return was Tk. 30276.46 per hectare. The average Benefit cost ratio was 1.75 indicates that cultivation of these variety is profitable to the farmer's level when all sorts of cost were taken into consideration. The highest BCR was found in Mymensingh district (1.96) which was followed by Sherpur (1.88), Kurigram (1.62) and Jamalpur (1.52) districts, respectively.

BINA 3

Profitability and technical efficiency of Binamoog-8 cultivation in some selected areas of Bangladesh

The average costs of Binamoog-8 cultivation were Tk. 46199 and Tk. 29500 per hectare on full cost and cash cost basis, respectively. The highest cost was incurred for human labour (47%) followed by fertilizers (11%), power tiller (10%) and irrigation cost (7%). The cost of Binamoog-8 cultivation was found highest in Jessore (Tk. 48481/ha) followed by that in Pabna (Tk. 46656/ha), Magura (Tk. 45871/ha) and Natore (Tk. 43787/ha) respectively. The average yield of Binamoog-8 was found to be 1641 kg per hectare. The yield was highest at Pabna (1705 kg /ha) followed by Magura (1694 kg /ha), Natore (1596 kg/ha) and Jessore (1568 kg /ha). The average gross margin was found Tk. 46368 on variable cost basis. Gross margin was highest in Magura (Tk. 49503/ha) followed by Pabna (Tk. 46485/ha), Jessore (Tk. 44808/ha) and Natore (Tk. 44676/ha) respectively. The average net return per hectare was Tk. 42447. The net return was highest in Magura (Tk. 46345/ha) followed by Pabna (Tk. 41602/ha), Natore (Tk. 41299/ha) and Jessore (Tk. 40540/ha) respectively. Benefit cost ratio was estimated at 1.92 and 3.01 on full cost and cash cost basis. The co-efficient of human labour was found positive and significant at 1% level, while that of land preparation, seed, fertilizer and organic manure were found positive but significant at 10 percent level. It showed that these variables had a significant and positive impact on Binamoog-8 production. Thereby it can be said that if the human labor, land preparation, seed, fertilizer and organic manure are increased by one per cent, per hectare yield of Binamoog-8 is estimated to increase by 0.080, 0.207, 0.008, 0.287 and 0.224 percent respectively. Irrigation and insecticides cost are statistically insignificant and showed negative relationship with Binamoog-8 production. The estimated coefficient of technical inefficiency model showed that the coefficient of farmers age, education and farming experience were negative but significant at 1% level which implies that technical inefficiency in mungbean production decreases with the increases in farmers age, education and farming experience. The coefficient of farm size and training was positive but not significant. About 59% farmers produced outputs which were very close to the maximum frontier output level (91%–99%). The mean efficiency of the Binamoog-8 producers was 88.5%, which indicates that they were made a production loss of 11.5% due to inefficiency factors. In other words, they were 11.5% apart from the frontier level.

Bangladesh Forest Research Institute
Forest Economics Division

BFRI 1

Impact of the Coastal afforestation of Bangladesh in respect of financial and socioeconomic conditions of local people

Pilot survey was conducted to determine the required number of sample plots for the forest resource assessment of the strip plantation under Patuakhali and Chittagong C-A Division raised during 1995-96 to 2000-01. Group discussion were arranged in each C-A Division with the local participant in three forest range area that would directly or indirectly have benefited from strip plantation. Among the participant of strip plantation from each range, 25 beneficiaries were selected randomly for interview regarding their production, employment and income. The required number of sample sizes for the study areas were determined as 200 plots (size 100 sq. meters) at 7.2% margin of error for Patuakhali and 180 plots at 8% margin of error for Chittagong C-A Division through pilot survey. These sample plots were allocated stratum (year-basis) wise proportionately for required data collection. The collected information were GBH/DBH of trees, number of tree species per plot, tree round log price of different size and species, fuel wood price,

COMPUTER AND GIS

The unit is responsible for overall management of Information and Communication Technology (ICT) relating to hardware, software, networking etc for establishing BARC as information hub of NARS so that the research system becomes strengthened and robust in terms of information availability, accessibility, dissemination etc. through online system. The unit plays a vital role to establish/strengthen ICT infrastructure to facilitate MIS related activities/services among NARS institutes. The activities also involved in preparing technical specification for procurement of computer hardware, software, networking and related goods/accessories, evaluating technical proposal, receiving and distributing ICT goods etc. The unit also provides support for troubleshooting of hardware, software, and crop zoning was an important outcome of GIS activity. The unit has developed some online databases and services which are accessible through BARC

nursery and plantation management cost etc. The Stratified Random Sampling was employed to assess the number tree stocking, tree biomass and forest carbon storing of the strip plantation raised during 1995-96 to 2000-01 under Patuakhali and Chittagong C-A Divisions.

MS Thesis Examiner: (Sher-e-Bangla Agricultural University)

By Dr. A.S.M. Anwarul Huq, MD

Title of the thesis

1. Economics of Value Added Mushroom Production and Marketing: A Study at the Farmers and Consumers Level of Dhaka District
2. Supply Chain Analysis through Value Creation in Rice Marketing at Some Selected Areas of Bogra District
3. Supply Chain Analysis of Onion Markets of Pabna and Dhaka Districts in Bangladesh

By Dr. Md. Mosharraf Uddin Molla

1. Marketing System of Chilli in Some Selected Areas of Bogra District
2. Value Chain Analysis of Potato in Selected Areas of Munshiganj District
3. An Economic Analysis of Potato Cultivation: A Study at Debiganj Thana under Panchagar District

network, internet/email and related services for smooth running of the system. In addition, it conducts various ICT based capacity building training, workshop, seminar for the personnel of BARC and NARS institutes. Besides, the unit performs activities like preparation of progress report, need assessment, review and evaluation of research program, recruiting of computer personnel etc. Personnel of the unit are also working as innovation officer and member of innovation team of BARC formed under Governance Innovation Unit (GIU) of Prime Minister's Office.

Geographic Information System (GIS) is another important functional part of the unit. Maintenance, necessary updating and output preparation of AEZ land resources database and local level Upazila Nirdeshika database (soil, land, nutrition and others) is an on-going activity of this unit. Land suitability assessment

website. The unit also provides strategic and technical support in establishing the National Agricultural Display Center (NADC) at BARC.

Major activities of Computer & GIS Unit

The personnel of Computer & GIS Unit accomplished the following activities during the period from July 2015 to June 2016:

1. Data Centre Operation

The proper functioning of data centre is very crucial in the context of storage and accessibility to MIS databases, email and internet service, and other relevant services through local area network (LAN), virtual private network (VPN). Subsequently, the personnel of the unit performed the activities for proper functioning of hardware, software and network system for smooth running of Data Centre. The activities are smooth operation and maintenance of file server, domain server, database and application server, file sharing, data backup and other relevant tasks. The unit also taken necessary measures to ensure proper functioning of antivirus for safeguarding of computer server and desktop/laptop under LAN and online power backup system (UPS), cooling system etc. The proper maintenance and operation of data centre is very much essential for providing services to various users with their information requirement.

During this period, the bandwidth of BARC leased internet connection was increased to 20 Mbps from 5Mbps. Another 8Mbps dedicated internet line was connected to the BARC Data Center from BanglaGovNet Project of Bangladesh Computer Council. This line is working as the redundant connection of the existing 20Mbps line to ensure the continuous internet service without any interruption. **Fig1**

2. Establishment of MIS at NARS institutes

The main responsibility under this activity was to provide required support for the development, deployment and operationalization of MIS (9 modules) at BARC and NARS institutes. Accordingly, the MIS has been deployed in 7 NARS institutes and BARC. Afterwards, data entry into the system started and while carrying out this activity, some bugs were identified. Consequently, Computer and GIS unit provided support to Project Coordination Unit of NATP and MIS development firm (Techno Vista Ltd.) in compilation

of bugs, prioritizing them and making schedule for fixing the bugs. Also, necessary support has been provided for remote access to server of BARC Data Centre by Techno Vista Ltd. through TeamViewer client to deploy the updated version of MIS. During this period, relevant support provided to NARS particularly BARI in operationalization of some modules of MIS and supervised data entry and validation activities of BARC.

3. National Agricultural Display Centre (NADC) Operation

During this period, Computer and GIS unit communicated with NARS organizations for updating/enrichment of display material, supervision, monitoring and technical support to ensure the smooth functioning of digital part such as Kiosk, Digital signage, TV screen, storage server for digital content, network devices etc. through troubleshooting and maintenance activities.

Actively involved in organizing the inauguration of NADC and performed all activities related to inauguration. Involved in preparation of rack, name plate, foundation stone, picture, map, banner, festoon, publication etc. and their alignment/placement in NADC, collection and organization of information required for technology databases, digital contents, and video documentary for NADC. Designed, developed and deployed the technology information system of BARI, BRRI, BJRI, CDB, SRTI and BTRI which include variety information, production technology etc. Played vital role in a) NADC monitoring/updating committee b) NADC visit/guide committee and c) Operation and maintenance committee d) Overall coordination committee etc. Prepared a list of 160 schools and colleges of Dhaka city and agricultural universities of the country and sent letters to the institutes regarding the visit of NADC. Prepared the application form for NADC visit and uploaded to website. More than 1000 local and foreign visitors visited the NADC during this period. Computer and GIS personnel worked as exhibitor to show and explain the items of NADC to visitors.

4. Project Development

- a. Proposal for extension of ARMIS project for 6 more months was prepared and submitted to KGF.
- b. A concept note on “Food Security Information System” has been developed and sent to MoA for IFAD funding

5. Project Implementation

a. Establishment of Agricultural Technology Information Network in Asia (ATIN)

During this period e-content of agricultural production technologies of 25 crops were developed and uploaded to AFACI website. Also, preparation of crop calendar for 15 crops Jute, Maize, Potato, Mungbean, Mango, Sugarcane, Tomato, Onion, Lichi, Lentil, Brinjal, Chili, Cotton, Guava and Jujube have been published in this period.

A total of 90,000 copies of the calendars (6000 copies for each crop) distributed among DAE, NARS institutes, KGF, relevant division of BARC and other relevant organizations. As an important activity of the project, two annual evaluation workshops of 10 AFACI projects presently under implementation in Bangladesh have been organized during this period dated 6 July 2015 and 27 June 2016 respectively. **Fig2** Accordingly, evaluation reports of AFACI project were prepared highlighting the progress of activities, achievements, ranking of projects according to performance and general recommendation.

b. Capacity enhancement of NARS through ICT-based Agricultural Research Management Information System (ARMIS) project

In ARMIS project, proposal for extension of ARMIS project for 6 more months was prepared and submitted to KGF that was approved later on. Research entry, edit and

- tainability purpose of the application. **Fig3**

6. Policy level contribution:

verification during this period were over 15,000 from about 150 organizations (including journals). Total number of research information available in the database till June 2015 was 26,500. Procurement of office equipments, stationeries, computers, multimedia projector, photocopier machine, AC etc. was done. Also following activities were done during this period:

- A series of training workshop on “ARMIS Application and its operation” were held at different research institutes and universities with an aim to give an orientation and usage of the system. During the period the workshop were held at 10 different locations such as BARI, BRRI, BSRI, BINA, BFRI, BLRI, BJRI, BARC, Barisal University, Sylhet Agri. University, Hajee Mohammad Danesh Science & Technology University (HSTU) and oriented about 600 plus scientist/academician all over the country.
- A series of hands-on training on “ARMIS Application” were held at different research institutes and universities with an aim to introduce the practical use and sustainability of the system. During the period the training were held at 8 locations such as BARI, BRRI, BSRI, BINA, BFRI, BLRI, BJRI and BARC and a total of 321 scientists from the NARS organizations were trained throughout the training programs.
- 13 Joint meeting held at Computer and GIS Unit with ARMIS team.
- Prepared 1 (one) brochure, 1 (one) user manual, videos on ARMIS usage guide and uploaded in ARMIS portal.
- Published ARMIS news in Facebook group “Krishi Bhabna” and BARC Facebook page
- Updated and added many new features in the 2nd version of ARMIS software for the sus
- Reviewed ÒAveniIqv welqK AvBb 2016Ó and accordingly, made comments/opinion on it and sent to MoA.
- Comments provided on a document sent by MoA on ICT service requirement of BARC.

- Comments provided on the MoU concerning Asian Micro-Satellite Consortium (AMC) during this period.

7. Research management/financial management and coordination:

The Director (Computer & GIS) attended in the internal review of research reports (2014-2015) and proposed research program (2015-2016) workshop of ASICT division of Bangladesh Agricultural Research Institute held in 9 July 2015. As an expert he gave important comments and suggestion on the research reports of 2014-15 and proposed research program of 2015-16.

The Director as an expert scientist also attended in central review and program planning workshop-2015 of ASICT division of Bangladesh Agricultural Research Institute held in 27 August 2015. He has provided valuable comments and feedbacks and made contribution in preparation of future research program of ASICT division.

8. Monitoring and evaluation of programs/activities of NARS institutes

As a team leader of monitoring team formed by Planning & Evaluation division of BARC Mr. Md. Abeed Hossain Chowdhury, Director (Computer and GIS) monitored the implementation progress of core research programs at Rangpur, Nilphamari and Dinajpur district. Two projects (i) Information of BARI technology at farmers' doorstep through mobile apps and (ii) Development of agricultural geodatabase in the Haor region for sustainable intensification are being implemented under BARC research grants were evaluated during this period.

9. Database Development

During this period, development of agricultural technology database (english version) application has been completed. Agricultural technologies developed by NARS and other organizations will be incorporated in the technology database. Also developed a) Web based Payroll Management System b) BARC archives database for storing publication (books, newsletter, journals etc.), tenders, news, events, achievements, unconventional documents etc. c) Land resources database d) Web application for accessing crop

calendar e) Analyzed and designed 2nd version of Daily Activity Management software.

Some database applications and services are updated during this period, such as a) Climate Database b) Web application for accessing maps and shape files c) Usage record for above database application and other services d) Online booking application for managing BARC resources like conference room, auditorium, training room etc.

10. Maintenance and Updating of BARC Website

The work is being carried out as a routine job. BARC website is anchored with national web portal and updated regularly. The upload and update information of the website is reported to MoA every month.

11. Climatic database

The daily climate data (temperature, rainfall, humidity, sunshine, wind speed, cloud coverage) of 2014 and 2015 collected from BMD. Monthly and historical average data upto 2013 uploaded to climate database which is linked with BARC website. The daily climate data for the year 2014 and 2015 will be uploaded soon after necessary processing is done.

It is mentioned that after necessary correction the data are analyzed and the outputs made available in the form of monthly and historical average under different scenarios.

12. The Essential Electronic Agricultural Library (TEEAL) facilities

The Essential Electronic Agricultural Library (TEEAL), a full-text, searchable digital library of articles from high-quality research journals in agriculture and related life sciences was installed at BARC data centre. The TEEAL service kept accessible to users of BARC.

13. Continuation of GIS Activities

Maintenance and necessary output preparation of AEZ land resources database and local level upazila nirdeshika database (soil, land, nutrition and others) has been continuing as an on-going activity. AEZ land resources data was used for crop

zoning study of Bangladesh. Also, the information of 15 (fifteen) upazilas of upazila nirdeshika database were used in SPGR GIS sub-project for crop zoning study. Uploaded base maps and soil maps of all upazila under Rangpur and Mymensingh division in the application named base and soil maps (<http://maps.barcapps.gov.bd>). During this period land suitability analysis and crop zoning of cotton crop is done.

14. Support to BARC and different component of NATP as PEC and TEC member

Necessary support provided to BARC and NATP for procurement of goods, works and services. Also Computer and GIS personnel involved in various recruitment at different organizations/projects and working as member secretary in goods receiving committee of BARC. Specification for procurement of computer & computer accessories, antivirus, dehumidifier, UPS etc. is prepared and submitted to procurement section of BARC. Necessary supports have been provided to BARC and NATP for procurement of goods, works and services. Due to unavailability of procurement officer, Computer and GIS unit personnel worked as Senior Assistant Director of Procurement section.

15. Support to divisions/sections of BARC for hardware/software/network/Internet; data analysis; multimedia presentations; Information sharing and resource management

Support provided to different divisions/sections to fix various types of computer hardware and software problems. Several types of maps, land resources, climatic and other data have been provided to scientists/researchers/extensionists as per requirement.

16. Support for planning, budgeting and procurement of computer resources (hardware, software & accessories etc.)

Support provided in the form of requirement assessment, specification preparation, budgeting for procurement of computer hardware, software and accessories to BARC and different projects i.e.

ARMIS, KGF etc. Inputs regarding procurement of ICT equipment with their estimated price were provided to PCU of NATP in preparing of DPP for NATP Phase-II.

17. Innovation Team activities

Innovation team is formed at BARC according to the gazette of Bangladesh government. There are 6 members from different divisions/sections of BARC. Computer and GIS unit organized a workshop on “Service innovation through ICT” at BARC where NARS institutes were also participated. During this period, annual report of 2015, service innovation work plan-2016, progress report of BARC activities according to ICT Act 2015 were prepared and sent to MoA. During this period, attended all monthly innovation meeting arranged by MoA, conducted 10 Innovation team meeting at BARC and distributed proceeding of the meetings, uploaded information of innovation team and its activities to BARC website under the menu Innovation as per guideline of MoA.

Completed many of the activities according to the Innovation workplan-2016 (such as innovation idea seeking from officers, approval of ADSL internet facility at residential telephone, digital file numbering training, BARC’s Facebook page and blog page creation etc.) and some are in progress (like online monitoring of projects, e-Filing, e-GP implementation, LAN based chatting software installation etc).

18. Reports to MoA

During this period, prepared several ICT related reports/documents required by the ministry of agriculture. Such as:

- Sodachar Sonkolon is prepared and sent to MoA.
- Citizen charter is prepared according to the new guideline and format.
- Report on Govt. Data Share Portal Developed and sent to MoA.
- Report on "ICT usage and e-governance sector selection” prepared and sent to MoA.

- Proposal for Independence award of BARC prepared for submission to MoA.
- Success of BARC report prepared, sent to MoA and uploaded in BARC website.
- Opinion of on implementation of project in Bangladesh entitled “Community-led e-auction application: Empowering Farmers’ Competitiveness in an Open Market System” by Dr. Sharif-As-Saber of RMIT university, Australia prepared and sent to MoA

organizations is imported into the database. To do this activity, extensive compilation work is done to align the data with the format of PGRFA database. Data import of NARS is done successfully. Took part in number of meetings arranged on PGRFA database.

19. Other activities:

- a. Application Hosting to National Data Centre (NDC) at Bangladesh Computer Council (BCC)

Computer and GIS unit created 3 (three) sub domains this year like <http://maps.barcapps.gov.bd>; <http://booking.barcapps.gov.bd>; and <http://archive.barcapps.gov.bd> in National Data Centre (NDC) of BCC. During this period, 3 (three) database application and services of BARC hosted in NDC using the mentioned sub domains.

- b. **Support to Installation and commissioning of BanglaGovNet network at BARC**

Under BanglaGovNet project of Bangladesh Computer Council (BCC), a network connection (intranet) established at BARC to be connected with countrywide network infrastructure among government offices. As part of this activity, 8 Mbps network bandwidth is provided and 3 IP telephony set is installed at BARC. The 8 Mbps bandwidth is configured as redundant connectivity with BARC’s leased line connectivity from BTCL.

- c. PGRFA database activities

Actively involved and provided necessary support for building of online PGRFA database. In order to carry out the task communication with stakeholder organizations for gathering, organization of PGRFA data according to the format is performed during this period. Data collected from different

II. HUMAN RESOURCES DEVELOPMENT

Crops

Training on Knowledge and Awareness Building on Agricultural Policies of Bangladesh

A three-day long training programme on *Knowledge and Awareness Building on Agricultural Policies of Bangladesh* was organized by Crops Division during 22-24 March, 2016 at BARC to update the scientists and officials on different agricultural policies and related issues for enhancing the capacity to address the national issues through following rules and regulations. A total of 40 participants from NARS institutes, DAE, BADC, SCA, AIS, DAM and MoA attended the programme. In the inaugural session, Dr. Abul Kalam Azad, Executive Chairman, BARC was present as the chief guest and Dr. Md. Rafiqul Islam Mondal, Director General, BARI was as the special guest. Dr. Md. Aziz Zilani Chowdhury, Member-Director (Crops), BARC chaired the session. Dr. Mian Sayeed Hassan, Chief Scientific Officer (Crops), BARC and training coordinator delivered the welcome address and briefing the training programme. In this training programme 16 lectures were included such as National Agricultural Policy, Agricultural Research Priorities, 7th Five-year plan, SDG's, CIP, Plant Quarantine Law, Food Safety Act, National Seed Policy, Bio-safety Guidelines and Biosafety Rules of Bangladesh GAP, Climate change etc. At the end of the training, participants received certificates from the Executive Chairman, BARC.



Inaugural Session of Training on Knowledge and Awareness Building on Agricultural Policies of Bangladesh

Training Programme regarding SAARC-GAP

A four day long training and field inspection for the governing body of Scheme Owner (SO-BARC) and Certification Body (CB-DAE) was organized under “Development of Standards and Scheme for Good Agriculture Practices (GAP) Implementation and Certification in Countries of SAARC (SAARC GAP Scheme)” project funded by FAO. The in house theoretical discussion was conducted at BARC while field visit was held at Masur Khola, Savar, Dhaka.

Review Workshop on Crop Protection Programme of NARS Institutes

Review Workshop on Crop Protection Programme of NARS Institutes: Research Progress 2014-15 & Research Programme 2015-16 was held on 05-06 August 2015. Crop protection was divided into two parts, i) Insect management and ii) Disease management. A total of 120 participants (60 on 1st day and 60 on 2nd day) from BARI, BRRI, BJRI, BINA, BSRI, BTRI, BSRTI, CDB and BARC were participated in the workshop. In this workshop Research progress for 2014-15 and proposed programs for 2015-16 was thoroughly discussed and decisions were made for implementation. Six expert members of respective field were also present in the workshop and provided their opinion/direction of research based on the national demand. Proceedings prepared based on the comments and opinion made on the workshop was sent to the respective institutes for necessary steps.

Review workshop on Crop Improvement Programme of NARS Institutes

The workshop on *Crop Improvement Programme of NARS institutes: Research Progress 2014-15 & Research Programme 2015-16* was held at BARC during 09-10 August 2015. Respective scientists of each institute presented their research progress (2014-15) and research programmes (2015-16) on crop improvement. Almost all major crops (rice, wheat, maize, oilseed, pulses, vegetables, fruits, tuber crops, spices, flower, jute, sugarcane etc.) were included in the programme. A total of 70 Scientists from 7 NARS institutes viz., BARI, BRRI, BINA, BJRI, BSRI, CDB and BSRTI participated in the workshop. Six experts from BAU, BSMRAU, SAU and DU provided their expert opinion in the workshop. Proceedings prepared based on the comments and opinion made on the workshop was sent to the respective institutes for necessary steps.

Review workshop on Crop Production Programme of NARS Institutes

Annual Review Workshop on Crop Production Programme of NARS institutes was arranged during 11-13 August 2015. Seventy scientists from BARI, BRRI, BJRI, BSRI and BINA were participated. Research progress for 2014-15 and proposed research programs for 2015-16 were thoroughly discussed and decisions were made for implementation. Expert members of respective fields were also present in the workshop and gave their valuable opinion/direction of research based on the national demand. Proceedings prepared based on the comments and opinion made on the workshop was sent to the respective institutes for necessary steps.

Expert consultation meeting to finalize the Manuals on Postharvest Handling of Cabbage and Tomato

An Expert consultation meeting under AFACI-Postharvest Project was organized at BARC on 26 August 2015 to finalize the Manuals on Postharvest Handling of Cabbage and Tomato in Bangla and English version.

Consultation workshop for preparing the country report on *The State of the World's Biodiversity for food and Agriculture: Bangladesh Part*

A day-long consultation workshop was held at BARC on 09 January 2016 for preparing first draft of the country report on *The State of the World's Biodiversity for food and Agriculture: Bangladesh Part* as per common format of FAO. Whereas Dr. Md. Aziz Zilani Chowdhury, Member-Director (Crops) BARC was national focal point and Professor Dr. Md. Shahidur Rashid Bhuiyan, Pro-Vice Chancellor, Sher-e-Bangla Agricultural University (SAU) was serving as expert provider. About forty participants including institutional focal points of NARS institutes, agricultural universities and other public universities were attended in the workshop. Thereafter, the first draft report which was reviewed by the experts of crops, livestock and fisheries through an expert consultation meeting on 12 January 2016. Subsequently first draft report submitted by BARC to FAO head quarter for their comments and suggestions. FAO had made some comments and suggestions on the report. In this context, a day-long workshop for revision of the country report of *The State of the World's Biodiversity for food and Agriculture: Bangladesh Part* was held at BARC on 02 March 2016. Forty five participants from different NARS institutes, agricultural universities and other public universities were participated the workshop. The report was finalized based on available information to meet up the guidelines of FAO. After inclusion the available information, the final report was submitted to FAO head quarter on 16 March 2016.



Concluding remarks by Dr. Abul Kalam Azad, Executive Chairman, BARC on Consultation workshop for preparing the country report on *The State of the World's Biodiversity for food and Agriculture: Bangladesh Part*

Pre-proposal Training Workshop on Seaweed Cultivation

A day long Pre-proposal Training Workshop on Seaweed Cultivation on 24 January 2016 was organized to build up awareness about importance and cultivation procedure. Three PPT presentation on Adaptive Trials on Seaweed were delivered from BARC, BARI and Dhaka University (DU) part of the project. Thirty one participants were attended from BARI, BARC, DAE, DU, KGF, BIRTAN, Hortex Foundation etc.

Seminar on National Vegetable Fair 2016 and Display of Vegetable

A 3-day long National Vegetable Fair 2016 and Display of Vegetable was organized by the Ministry of Agriculture, Government of the People's Republic of Bangladesh during 17 to 19 January, 2016 at Khamarbari, Dhaka. As a team member BARC, the scientists of Crops Division have actively involved for arranging a seminar on *Nutrition Security and Poverty Alleviation through Diversified Vegetable Production round the year* on 17 January 2016 at Krishbid Institution Bangladesh (KIB), Farmgate, Dhaka to make the fair fruitful. About 1200 participants including Govt. officials, scientist, personnel from DAE and private sector as well as farmers were attended the seminar. Mr. Anisul Islam Mahmud, MP, Hon'ble Minister for Water Resources, Government of the People's Republic of Bangladesh was present as Chief Guest and Mrs. Matia Chowdhury, MP, Hon'ble Agriculture Minister was present as special guest in the seminar. Dr. Abul Kalam Azad, Executive Chairman, BARC was present as guest of Honour. Mr. Shyamal Kanti Ghosh, Secretary, Ministry of Agriculture presided over the seminar session. Welcome address was delivered by Kbd. Mr. Md. Hamidur Rahman, Director General, Department of Agricultural Extension. Professor Dr. Md. Shahidur Rashid Bhuiyan, Pro-Vice Chancellor, Sher-e-Bangla Agricultural University presented the keynote paper. Dr. Bhuiyan emphasized the role of vegetable on nutrition and food security, diversified

varieties/cultivars of vegetable in the country, production calendar of vegetables and year round vegetable production models.



Mr. Anisul Islam Mahmud, MP, Hon'able Minister for Water Resources as Chief Guest, Begum Matia Chowdhury, MP, Hon'able Minister for Agriculture, as Special Guest, Mr. Shyamal Kanti Ghosh, Secretary, Ministry of Agriculture and Dr. Abul Kalam Azad, Executive Chairman, BARC as Guest of Honor graced the Seminar

National Workshop on Agricultural Biotechnology: research achievement, present status and future plan

A two-day long National Workshop on *Agricultural Biotechnology: research achievement, present status and future plan* was held at Bangladesh Agricultural Research Council, Dhaka during 14-15 May, 2016 for reviewing the present status of biotechnology and molecular breeding research in Bangladesh for future planning in this area on priority basis. The inaugural session of the workshop was presided by Prof. Dr. Shah-E-Alam, Department Genetics and Plant Breeding, Bangladesh Agricultural University. Dr. Md. Aziz Zilani Chowdhury, Member-Director (Routine Charge), (Crops), BARC delivered welcome address. Prof. Dr. Lutfur Rahman, Former Professor, Department of Genetics and Plant Breeding, Bangladesh Agricultural University presented keynote paper on *Agricultural Biotechnology and Molecular Breeding: Prospects and Constraints in Bangladesh*. Seven expert members from BAU, BSMRAU, SAU,

BSTU, DU and KGF contributed through their expert opinion for making the workshop fruitful. A total of 50 participants including scientists from BARC, BARI, BRRI, BINA, BSRI, BJRI, BTRI, BFRI (Forstry), BLRI, BFRI (Fisheries), NIB, BADC, CDB, BAU, SAU, BSMRAU, Sylhet Agricultural University, DU, RU, BRAC, AIC, Supreme Seed, Lal Teer Seed Ltd. etc. participated in the workshop.

Twenty three technical papers were presented as highlighted background information, target characters of crops, achievement and present status of biotechnology, utilization of biotech research output in the field level, research thrust area, available facilities, constraints etc. Four technical sessions were chaired by Prof. Dr. M. A. Khaleque Mian, Department of Genetics and Plant Breeding, BSMRAU, Gazipur; Prof. Dr. Md. Shahidur Rashid Bhuiyan, Pro-Vice Chancellor, SAU, Dhaka; Prof. Dr. Shah-E-Alam, Department of Genetics and Plant Breeding, BAU, Mymensingh and Prof. Dr. Rakha Hari Sarker, Department of Botany, DU, Dhaka, respectively. Dr. Abul Kalam Azad, Executive Chairman, Bangladesh Agricultural Research Council, Dhaka was presided over the recommendation session. The rapporteur's of four technical sessions were presented the reports.



Concluding address by Dr. Abul Kalam Azad, Executive Chairman, BARC in the recommendation session of National Workshop on Agricultural Biotechnology Monitoring and evaluation of the research project

Livestock

Workshop on the Review of Avian Influenza and its Prevention and Control Measures

Workshop on the Review of Avian Influenza and its Prevention and Control Measures taken in Bangladesh, was held on 09 June, 2016 that was initiated with the inaugural speech of Dr. Shah Md. Ziqrul Haq Chowdhury, MD (Livestock), BARC, followed by technical sessions. There was no formal inaugural session, because of holy Ramadan. There were three Technical Sessions in the workshop. A total of 7 papers from BLRI, BAU, CVASU, DLS, IEDCR and FAO



were presented under Technical Sessions-1 and 2, which were chaired by Dr. Nitish Chandra Debnath and Dr. Kazi M. Kamaruddin, respectively. Technical Session-3 (Recommendation Session) was chaired by Dr. Abul Kalam Azad, Executive Chairman, BARC, where Rapporteur's Report of Session-1 and 2 were presented and paper-wise discussions were held to prepare Recommendations. A total of 37 participants from BARC, BLRI, DLS, BAU, CVASU, SAU (Dhaka), SAU (Sylhet), BSMRAU, RU, HSTU, SAC, BRAC and Advance Animal Science Co. Ltd. attended the workshop. The workshop was closed following the speech of the chair. A Proceeding of the workshop was also published. The workshop was funded under Revenue Budget of BARC.

Forestry, NRM

National Seminar on Fruit Tree Plantation Program

Organized a national seminar on fruit tree plantation program on 16 June, 2016 at KIB Auditorium, Farmgate, Dhaka. Honorable Commerce Minister Mr. Md. Tofael Ahmmed, MP, as Chief Guest, Special guest was Motia Chowdhury, MP, Honorable Agriculture Minister and the Seminar was presided by Mr. Mohammad Mainuddin Abdullah. Secretary, Ministry of Agriculture. Prof. Dr. Md. Mahbubur Rahmann, VC, BSMRAU, Gazipur was the keynote

speaker. The programme was undertaken as a part of national plantation program.

World Food Day Seminar

Coordinated World Food Day Seminar was held on 16 October 2015 at BARC auditorium, Farmgate, Dhaka. The seminar was organized by Forestry unit, Natural Resource Management Division, BARC. The Seminar was presided by Secretary, Ministry of Agriculture. Honorable Agriculture Minister Motia Chowdhury, MP was the Chief Guest and special guest was A.H.M. Mustofa Kamal, Honorable Planning Minister. The theme of seminar was “Social protection and agriculture: breaking the cycle of rural poverty”. Prof. Dr. Md. ShamsUddin, VC, Patuakhali Science and Technology University were presented the keynote paper.

Agricultural Engineering, NRM

Training on Use of Farm Machinery and Efficient Irrigation System Management

Organized training course on *Use of Farm Machinery and Efficient Irrigation System Management* during 08-12 May 2016 at BARC, Dhaka. In this training programme, forty participants from NARS scientists of BRRI, BARI and BINA; Universities, DAE; RDA; BADC and BMDA participated to update skill of



Certificate giving ceremony of the Training on Use of Farm Machinery and

agricultural machinery use and efficient irrigation system management.

Workshop on Irrigation and Water Management Technologies

Annual Workplan Workshop 2015-16

A day long workshop on *Annual work plan workshop 2015-16* organized by Planning and Evaluation Division

Organized workshop on *Irrigation and Water Management Technologies: Present Status and Future Proposition* which was held in the Conference Room #1 of Bangladesh Agricultural Research Council on 14 March 2016. About eighty participants from the National Agricultural Research Systems (BARI, BRRI, BJRI, BINA and BSRI), Bangladesh Agricultural Development Corporation, Barind Multipurpose Development Authority, Department of Agricultural Extension, Rural Development Academy, Bangladesh Water Development Board, Institute of Water Modeling, International Rice Research Institute, Sylhet Agricultural University, Haji Danesh Science and Technology University, Proshika, CIMMYT and Bangladesh Agricultural university were participated. The workshop was split into inaugural, two technical and concluding sessions. Based on participants' opinion, experts' comments and rapporteurs report, recommendation was finalized and sent to respective stakeholders.

Soils, NRM

Use of Fertilizer Recommendation Guide-2012

Soils Unit of BARC conducted a 3-day long training program on Use of Fertilizer Recommendation Guide-2012 during 21-23 March 2016. A total of 40 participants from different NARS institutes (BARI, BRRI, BINA, BJRI, BSRI, BTRI, BFRI, SRDI, CDB and BSRTI), universities, DAE and BADC attended the training.

Research Review and Planning Workshop of Soils Program of NARS Institutes

Soils Unit of BARC also organized the “Research Review and Planning Workshop of Soils Program of NARS Institutes” during 08-10 August 2105 in the last year in which a total of 80 participant from different NARS institutes, senior scientists, university teachers, DAE personnel and representatives from international organizations attended the workshop.

Planning and Evaluation

was held on 14 August 2016 at BARC conference room-1. The objective of the workshop was to review the progress of approved work plan of FY 2015-16 and discussion on annual work plan of FY 2016-17. There

was an inaugural session followed by technical sessions. The inaugural session was presided by Dr. Paresh Chandra Golder, Member-Director (Planning & Evaluation), BARC. Dr. Abul Kalam Azad, Executive Chairman, BARC was present as a chief guest. In the technical sessions, each Head of the Division/Centre/Unit has presented their activities and report in the workshop. Executive Chairman, BARC in his concluding remarks opined and hoped that all Division/Centre/Unit should revise their work plan according to the workshop's comments. He also suggested that taking necessary action by all Head of Division/Centre/Unit in this regard.

Training on Project Development and Management

A five day-long training workshop on *Project Development and Management* was organized by the Planning and Evaluation Division, BARC during 14-18 February 2016. Dr. Abul Kalam Azad, Executive Chairman, BARC presided as a chief guest in the inaugural session. Dr. Paresh Chandra Golder, Member-Director (Planning & Evaluation) presided over the inaugural ceremony. Senior Officers from different divisions of BARC were also present in the inauguration ceremony. Dr. Md. Abdul Awal, Principal Scientific Officer (Planning & Evaluation) BARC and the course coordinator of the workshop delivered welcome address. Thirty participants from the different NARS institutes including BARC attended the workshop. Resource persons were drawn from BARC, National Academy for Planning and Development (NAPD), Office of the Controller General Accounts and Directorate of Fire service and Civil defense Ministry of Home affairs. The course content of the training workshop included the topics on project cycle, project appraisal, logical framework, preparation of different types of project documents (DPP/RDPP/TPP), critical path method, result based monitoring, PPR-2008, financial delegations, SWOT analysis, Objectives tree analysis and problem tree analysis etc. The workshop was conducted based on class lectures, practical sessions and open discussions. The chief guest in his speech mentioned that this training workshop was organized to make the participants conversant with project planning and management. The chairperson of the training workshop in his speech hoped that this training would be helpful for the participants to prepare and manage different kinds of projects properly and efficiently. The workshop ended on 18 February, 2016 through a certificate giving ceremony where the Executive Chairman, BARC was present as chief guest.

Field Monitoring Activities under Research Grant Fund 2015-16

A day-long workshop on *Field Monitoring Activities under Research Grant Fund 2015-16* of BARC was held at Conference Room-1, BARC on 01 June 2016. Planning and Evaluation Division of BARC organized the workshop. There were 33 projects implemented by different NARS institutes and Agricultural Universities. A total of 90 participants comprising 7 Monitoring Team Leader's & Team Member's, Principal Investigators of the Projects, Member Directors, Directors, CSOs and PSOs of BARC were participated in the workshop. Dr. Abul Kalam Azad, Executive Chairman, BARC was present as the Chief Guest. Dr. Paresh Chandra Golder, Member-Director (Planning & Evaluation), BARC presided over the inauguration session. The objective of the workshop was to provide clear and concise understanding the present status of the projects. Team leader or his representative presented field condition, financial status, success, and constraints of the projects. A good number of recommendations were adopted through open discussions. The recommendation and closing sessions were presided over by Dr. Abul Kalam Azad, Executive Chairman, BARC. The workshop was ended with a vote of thanks.

A day-long workshop on Understanding and Implementation of Sustainable Development Goals (SDGs) through Annual Program Agreement (APA) was held at Conference Room-1, Bangladesh Agricultural Research Council on 18 April, 2016. Mr. Md. Nasiruzzamam, Additronal Secretary (Admn. & Input) Ministry of Agriculture and Team Leader, APA, MoA was present as Chief Guest. Dr. Abul Kalam Azad, Executive Chairman, BARC presided over the inauguration session. About 60 participants from policymaker, scientists, extension personnel, professors, experts, delegates from private seed companies, NGO personnel's and farmers took part in the workshop. More than 30 participants took part in the workshop. Different organizations like BADC, DAE, BARI, BRRI, BINA, DAM, CDB and SCA were presented their own institutional SDGs Programs. Mr. Mohd. Monirul Islam, Deputy Chief, General Economic Division, Planning Commission, Sher-e-Bangla Nagar, Dhaka delivered his speech on Linking between SDGs & Seven Five Years Plan: Focus on Agriculture and Food Security of Bangladesh. Dr. Shamsul Alam, Member (Senior Secretary) General Economic Division, Planning Commission, Sher-e-Bangla Nagar, Dhaka also

discussed about “From MDG to SDGs: Role of Agriculture in 2030 Agenda for Sustainable Development”. A good number of recommendations were prepared from the open discussions. The recommendation session and closing was presided over

AERS

Financial and Economic Profitability of Agricultural Enterprises

A training programme on *Financial and Economic Profitability of Agricultural Enterprises* was held on 8-12 November 2015 at BARC. Twenty scientists (Agricultural Economist) of NARS Institutes attended the training programme.

Review of Socio-economic Research Programmes of NARS Institutes

A workshop on *Review of Socio-economic Research Programme (2015-16) and Future*



Research Programme (2016-17) of NARS Institutes was held on 02 June 2016 at Bangladesh Agricultural Research Council, Dhaka. In the inaugural session Dr. S.M. Anwarul Huq, Member-Director (AERS), BARC presided over the session. A total of eighty participants including scientists, professors, agriculture experts and delegates attended the workshop from different research organizations, universities and private sectors. The present and future research activities presented by the Head or nominee of the related division of NARS institutes. Two technical sessions were presided over by Professor Dr. Rezaul Karim Talukder, Advisor, MUCH, FAO/MoFood and Dr. S M Khalilur Rahman, Former Member-Director (AERS), BARC, Dhaka. Five expert reviewers were reviewed the whole presented research projects critically. However, the following suggestions/recommendations were made by the house from the day long workshop:

by the Dr. Abul Kalam Azad, Executive Chairman, BARC. He suggested some recommendations along with the recommendations made by the participants. The workshop was ended with a success.

Bangladesh Agricultural Research Institute

Research Programme (2015-16):

1. Cooling system may be cost-effective for super market chain, if lots are followed along this chain.
2. Why pulses production is not increased much despite developing more HYV varieties and there exist comparative advantage of producing pulses in Bangladesh? This may be discussed.
3. Super shops generally purchased vegetables from Dhaka wholesale markets instead of purchasing directly from growers. In that case, costs, margins, value addition etc. may be assessed along this chain.
4. Wheat and Maize may be dealt with separately for easy comprehension of findings and observations.
5. Why maize production increased marginally in the last year compared to a year earlier? This may be identified.
6. Why pumpkin prices fluctuate significantly during the season despite higher production this year? What measures to be taken to reduce this high intra-year price variation of pumpkin?
7. Problems of producing and marketing of summer tomato may be identified. Why its production is not increased despite high demand during summer.
8. Impact of labour migration (from rural to urban area) on wages, mechanization, livelihood etc. in rural area may be identified.

Future Research Programme (2016-17):

FP1:

- i. It can be two different studies for Wheat and Maize.
- ii. Base line survey is necessary for the study.
- iii. More investment to be required in case of impact analysis

FP2:

- i. Potato varieties may be specified.

FP3:

- i. Comparative study is needed for assessing three technologies of conservation agriculture.

FP4:

- i. Title may be revised and it can be “Technical Efficiency of Maize Cultivation”.

FP6:

- i. Title may be changed as “Production, Marketing and Post-harvest losses of litchi cultivation”.

FP7:

- i. Economic part can be deleted from the title.

FP9:

- i. Secondary data, historical data, rainfall and temperature data should be considered.
- ii. Title is overwhelmed.
- iii. Land fragmentation is not related to climate change.

FP 10:

- i. Title may be reviewed.

Bangladesh Rice Research Institute (BRRI)

Research Programme (2015-16):

1. Why area under HYV and Hybrid rice did not increase recently? Why only three old MV rice (BR28, BR29 and BR11) dominated till now despite development of more new varieties in the recent past?

2. Why production cost of rice in Bangladesh is higher compared with India? What measures to be taken to reduce production cost of rice in Bangladesh?
3. It is necessary to see the comparative economic performance of rice varieties so that the farmers could replace production choice by reliable and easily accessible variety.
4. Why 55 percent area coverage of Indian modern variety should be found out.
5. In the case of marketable and marketed surplus of rice all categories of rice producing areas need to be considered keeping in view the country’s situation at last with respect to surplus, deficit and normal condition of the areas.
6. Explain how the post-harvest technologies can help to reduce production losses and increase farm productivity with the participation of women in particular.

Future Research Programme (2016-17):

FP 2:

- i. Estimation of cost and return can be deleted from the title.
- ii. Title may be as “Profitability of MV rice cultivation at farm level”.

FP 9:

- i. Title can be changed according to objectives of the study.

FP 10:

- i. Impact study should be done for the interest of the farmers.
- ii. Title can be revised as “Impact of rice production training to disseminate BRRI technology”.

Bangladesh Livestock Research Institute (BLRI)

Research Programme (2015-16):

1. As we import mainly milk powder, comparative advantage of producing milk

- powder instead of fresh milk may be found out.
2. The BCR is found 1.06 of fresh milk producers which is very low. Farmers will not accept it. Better to revise it by farm gate price.
 3. In the second study (Economic Impacts of Food and Mouth disease Outbreak on cattle) seems to be a comparative study of the diseased and the diseased free cattle households, may be in the same area or different areas. It is obvious that the diseased dairy cattle will benefit the households lower, although the amount of loss is not know. Sometimes both the cattle and their calves may die. This needs detailed estimations.

Future Research Programme (2016-17):

FP 1:

- i. Title may be changed as “Socio-economic impact of establishment of newcastle disease free zone in village chicken in some selected area of Bangladesh”.
- ii. Objective no 2 can be revised.

Bangladesh Sugarcrop Research Institute (BSRI)

Research Programme (2015-16):

1. The study revealed that *gur* production is more profitable than selling cane to the mills. In that situation, what policies need to be adopted in Bangladesh?
2. Why production cost of sugar in Bangladesh is higher compared to even neighboring countries? Study in this aspect may be conducted.
3. BCR should be calculated both on the basis of full and cash cost.
4. Feasibility study is necessary for sugarcane production in hill areas.
5. Why farmers/processors are not able to utilize sugar bit that need to be identified.

6. Is sugarcane juice vending more profitable to other types of vending and can we raise its profitability and help raise vending income?

Future Research Programme (2016-17):

FP 1:

- i. Title and objective can be checked.

FP 2:

- i. Term “profitability” covers both financial and economic profitability.
- ii. Street sugar cane juice is not hygienic. Think before doing the programme.

Bangladesh Institute of Nuclear Agriculture (BINA)

Research Programme (2015-16):

1. Yield gap may be shown in percentages instead of quantity. How this gap can be reduced? The Constraints to reducing yield gap may be identified.
2. It is necessary to find out why farmers do not accept agricultural technology regarding pulse and oilseed crops and what are their problems to accept it.
3. Adoption level of BINA *dhan-17* may be compared with the BRRI varieties is considered comparable, may be with those that can be grown in the same season and the land.

Future Research Programme (2016-17):

FP 1:

- i. BINA released lentil variety may be deleted from the title and it can be “Impact assessment of BINA masur-5”.
- ii. Cob-doglus production function is not appropriate for impact assessment?
- iii. Methodology is not clear and it should be revised.

FP 2:

- i. Title should be clear whether it covers BINA released all crops or specific crop

Bangladesh Forest Research Institute (BFRI)

Research Programme (2015-16):

1. Baseline information of forestry resources should come out for impact analysis.
2. Farmers participation, willingness, sharing should come out from the study and these types of studies should be continued in future.
3. The contribution of afforestation to climate change is necessary to find out from the study.
4. Study should be undertaken relating to the plantation of exogenous tree varieties like *Akashmoni* in the *Bhawal* region of Gazipur district and carefully evaluate their environmental effect on soil fertility, air and water pollution and the local fruit orchards.

Future Research Programme (2016-17):

FP 2:

- i. Title can be revised.

Post Budget Seminar

A Post Budget Seminar was held at BARC Auditorium on 11 June 2016, which is organized jointly by AERS Division and Bangladesh Agricultural Economists Association. A key note paper was presented on “Review of the National Budget 2016-17: Agriculture of Bangladesh Perspective”. The Chief Guest was Mr. Abul Mal Abdul Muhit MP, Honourable Minister, Ministry of Finance, Government of the Peoples Republic of Bangladesh. Krishibid Dr. Md. Abdur Razzak MP, Chairman, Parliamentary Standing Committee on the Ministry of Finance attended the seminar as a Special Guest. Professor Dr. Shamsul Alam, Member, Planning Commission (Senior Secretary) & President, Bangladesh Agricultural Economists Association was presided over the seminar.

Computer and GIS Unit

This Unit has organized and conducted the following training during the period:

Sl. No.	Title	Duration	Participant	Venue	Funding source
1.	Training on <i>Windows & Linux Server Administration and Network Infrastructure from 06-10 December, 2015 under revenue budget.</i>	5 days (06-10 December, 2015)	15 participants from BARC and 7 NARS institutes	Computer & GIS Unit, BARC	BARC
 <p>Post Budget Seminar was held at BARC Auditorium on 11 June 2016</p>					
2.	Training on “Digital	2 Days (2-3 April	Total 84 participants	Computer &	ARMIS Project

Sl. No.	Title	Duration	Participant	Venue	Funding source
	file numbering and e-Filing”	2016).	attended the training. The training held in two batches-one for officers and other for staffs.	GIS Unit, BARC	
3.	Training workshop on “ARMIS software and its operation”	10 Feb 2016	84 participants from BSRI, SRDI, BARI, BRRI, BSRTI and Rajshahi University	BSRI	ARMIS Project
		29 Feb 2016	80 participants from PSTU, BARI, BINA, BRRI and SRDI	Barisal University	
		15 Mar 2016	88 participants from SAU, SUST, BARI, BRRI, SRDI, BINA and BSRI	Sylhet Agricultural University	
4.	Hands on training on “ARMIS Application”	12-13 April 2016	84 participants from BARI	BARI	ARMIS Project
		18 April 2016	42 participants from BRRI	BRRI	
		20 April 2016 Ishurdi.	35 participants from BSRI and BSRTI	BSRI	
		25 April 2016	41 participants from BINA and BFRI (Fisheries)	BINA	
		04 May 2016	42 participants from BFRI	BFRI, Chittagong	
		09 May 2016	20 participants from BLRI	BLRI	
		16 May 2016	32 participants from BJRI	BJRI	
		18 May 2016	Total 25 participants from BARC, CDB and SRDI	Computer & GIS Unit, BARC	
5.	Workshop on “ARMIS Application and it’s operation”	29 May 2016	Total 110 participants from HSTU, BARI, SRDI, CDB, BSRI and BJRI	Hajee M. Danesh Science & Technology University	ARMIS Project
6.	Annual evaluation workshop of AFACI projects in Bangladesh	6 July 2015	50 participants from BARC, NARS institutes and others	BARC	AFACI –ATIN Project
7.	Annual evaluation workshop of AFACI projects in Bangladesh	27 June 2016	50 participants from BARC, NARS institutes and others	BARC	

Manpower Development Activities

Manpower and Training Unit, alongside its regular activities of management of higher study programs (in-country revenue funding PhD program and CSISA-BD Ph.D program), has organized 13 programs (five training programs, two workshops, four seminars and two meetings). During July 2015 to June 2016, a total of 3486 scientists/officers from the NARS institutes including BARC and other associate organizations participated in the revenue/other sources funded training/workshop/seminar/higher study programs at home and abroad. The major activities that Manpower and Training Unit has accomplished/ helped implementation during the reporting period are delineated below.

2. In Country PhD (Revenue)

One of the major tasks of Manpower of Training Unit of BARC is to offer higher studies for NARS scientists in various disciplines of agriculture. Under a batch (2013-2014) 19 NARS scientists are perusing PhD in the country under revenue funding. The financial management and performance monitoring activities in this connection are being carried out as usual.

2.1 In Country PhD (CSISA-BARC Scholarship Program):

There was a provision of five slots for in-country PhD under CSISA-BARC Scholarship Program. All the five PhD researchers - one from BARC and two from BARI, one from BINA and another from BFRI (fisheries) are involved with their PhD research activities. The program is being jointly funded by IRRI, CIMMYT and WorldFish Centre under CSISA-BD project. The financial management and performance monitoring activities in this connection are being carried out as usual. It may be mentioned that three scientists are about to complete their program.

3. Foreign Training/seminar/workshop/study tour

During the reporting period other than in country activities, Manpower and Training Unit also initiated and implemented foreign training/seminar/workshop/meeting in different countries of the world. A total number of 27 research managers/scientists/personnel under different fields of agriculture and cross cutting issues attended 37 programs (training/seminar/workshop/study visit/meeting) to help enrich their professionalism in order to achieve the country's ultimate goal to ensure food and nutrition security. Detailed activities are furnished below:

14	Dr. Paresh Chandra Golder M-D (P&E), BARC	2 nd Workshop of the Exchange and Cooperation Consortium for Agricultural Sciences and Technology in China-South Asia (ECCAST-CAS)	26-31 October 2015	China	YAAS, China
15	Dr. Debasish Sarker, PSO, BARI	Do	Do	Do	Do
16	Dr. Md. Abu Zaman Sarker, PSO, Wheat, BARI	Do	Do	Do	Do
17	Dr. Mohammad Akhlesur Rahman, PSO, BRRI	Do	Do	Do	Do
18	Dr. Md. Mahbubur Rahman, SSO, BSRI	Do	Do	Do	Do
19	Dr. A.S.M Anwarul Huq, Member-Director (AERS), BARC	To participate in the CABI Asia-Pacific Member Country Consultation	04-06 Nov.2015	Malaysia	CABI
20	Dr.Md. Saifullah, PSO, Forestry Unit (NRM), BARC	Regional Training on Successful Climate Smart Resilient Agricultural Technologies	16-20 Nov. 2015	India	SAARC
21	Dr. Md. Abdul Awal, CSO (P&E), BARC	In the High Level Policy Dialogue on Investment in Agricultural Research for Sustainable Development in the Asia-Pacific Region	08-09,10 Dec. 2015	Bangkok, Thailand	APAARI

22	Dr. Mohammad Shahjahan, CSO, BARC	Do	Do	Do	Do
23	Dr. S.M Khorshed Alam PSO (Crops) BARC	Study Visit under the FAO Project "Implementation of GAP in SAARC Countries: SAARC GAP Scheme"	18-23 January 2016	New Delhi, India	FAO
24	Shah Md. Monir, Snr. Scientific Editor, BARC	Completion of remaining part of PhD	Jan.17 to April 16, 2016	Thailand	Self/ Kasetsart University
25	Dr. Md. Monirul Islam Director (Nutrition), BRC	FAO zero hunger Regional Meeting	25-26 Jan 2016	Thailand	FAO
26	Dr.Mohammad Shahjahan, CSO (Forestry), BARC	In the TAP Meeting and Third TAP Partnes Assembly.	19-21 January 2016	Kigali, Rwanda	TAP/FAO
27	Dr. A.S.M Anwarul Huq, Member-Director (AERS), BARC	In the workshop on Training of Trainers for Official statistics	29 Feb. to 3 March 2016	Chiba, Japan	SIAP
28	Dr. Nazmun Nahar Karim PSO (Ag. Egn), BARC	Workshop on the Regional Database of Agricultural Mechanization in Asia and the Pacific	29-30 March 2016	Malaysia	UNESCAP (CSAM)
29	Dr. Mohammad Khalequzzaman, CSO, BRRI, Gazipur	4 th AFACI International Training Workshop on Germplasm Management System	18-27 April 2016	Jeonju, Korea	AFACI
30	Dr. Md. Abdul Malek, PSO, BARI, Gazipur	Do	Do	Do	Do
31	Dr. Mian Sayeed Hassan, CSO (Crops) & Director (TTMU), BARC	BIMSTEC Workshop on Development of GAP	25-29 April 2016	Chonburi Thailand	Thai Govt
32	Md. Aziz Zilani Chowdhury, M-D (Crops), BARC	The State of Asia's Biodiversity for Food and Agriculture	26-28 April	Bangkok, Thailand	FAO
33	Md. Mustafizur Rahman, Protocol Officer, BARC	Utilization of Agriculture Science and, Technology to Alleviate Poverty and ensure Food Security in Developing Countries	10 May 2016	Kabul, Afghanistan	SAARC
34	Dr. Md. Saifullah, PSO, Forestry Unit (NRM), BARC	4 th AFACI General Assembly	17-20 May	Colombo, Sri Lanka	AFACI
35	Dr. Abul Kalam Azad, Executive Chairman, BARC	Eighth Trondheim Conference on Biodiversity " Food System for a Sustainable Future	31 May- 3June	Norway	Norway Environment Agency
36	Ms. Susmita Das Senior Documentation Officer, BARC	Participate in the "Pulses for Sustainable Agriculture and Human Health"	31 May to 01 June, 2016	New Delhi, India	IFPRI
37	Dr. Md. Abdus Salam, PSO (Crops), BARC	2 nd AFACI Training Workshop on Post-harvest Management Technology for Horticultural Crops.	15-28 June, 2016	Bangkok, Thailand	AFACI

4. In-country Training/Seminar/Workshop

During the reporting period 25 training programs and 26 workshops were arranged by different divisions/units/centre of BARC. Under revenue funding 14 training programs and 18 workshops were organized

in which 502 and 975 scientists/officers participated respectively. During the reporting period 4 seminars were held under revenue funding in which 430 scientists/officers participated. Detailed lists are given below:

**Programs Implemented During 2015-2016
Training (Revenue)**

Div/ Unit	Sl. No	Activity	Venue	Duration	Participa nt No.	Funding
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<i>Crops</i>		... and Awareness Building on Agricultural Policies of Bangladesh	BARC	22-24 March 2016	40	Revenue
<i>P&E</i>	2	Training on Project Development and Management (Source: BARC)	BARC	7-11 February 2016	30	Revenue
	3	Training Workshop on Critical Path Way (CPM)	BARC	24 May 2016	33	
<i>AERS</i>	4	Training on Financial and Economic Profitability Analysis in Agricultural production	BARC	8-12 Nov/15	30	Revenue
<i>NRM (Agril Eng.)</i>	5	Training on Use of Farm Machinery and Efficient Irrigation System Management.	BARC	8-12 May 2016	40	Revenue
<i>NRM (Soils)</i>	6	Training on use of Fertilizer Recommendation Guide-2012	BARC	21-23 March 2016	40	Revenue
<i>Nutrition</i>		... and preservation of Agro-products	DAE/Cox 'Bazar UP/ Teknaf	5 days (1-batch) 27-31 Dec. 15	35	Revenue
<i>Computer & GIS</i>	8	Training on Operation and Maintenance of Hardware & Network.	BARC	6-10 Dec. 2015	20	Revenue
<i>TTM U</i>	9	Training on Technology Transfer for Dinajpur & Rangpur Region's DAE Officers (Two batches with 40 each)	BARC	30-31 May 2016	80	Revenue
<i>Manpower & Training</i>		Information Act	BARC	12 April 2016	50	Revenue
	11	Training on Government Performance Management (GPM)	NIPA	7-8 June 2016	50	Revenue
	12	Training on Government Performance Management (GPM)		7-8 June 2016	50	Revenue
		Reporting Procedure" at NAPD (Dr MA Awal & Dr. Md. Kabir)	NAPD, Nilkhet, Dhaka	1-5 Nov 2015	2	Revenue
		Management (Mr. Md. Haider)	BIMA Dhaka	18-19 Dec. 2015	2	Revenue
<i>AIC</i>		Introduction	BARC	29/7/2015	35	Bil & MilliandGF
<i>Computer & GIS</i>		Training on Digital File Number Implementation and Basic ICT (Officers 37, Employee 47)	BARC	2-3 April. 2016	84	KGF
		Training program on the "ARMIS Software and its Operation	BJRI	07 Oct. 2015	90	KGF
		Training program on the "ARMIS Software and its Operation	BRRI	14 Oct. 2015	83	KGF
		Training program on the "ARMIS Software and its Operation	BLRI	20 Oct. 2015	78	KGF
		Training program on the "ARMIS Software and its Operation	BINA	28 Oct. 2015	82	KGF

		Hands-on Training on ARMIS Applications	BARI	12-13 April 2016	84	KGF
		Hands-on Training on ARMIS Applications	BIRRI	18 April 16	42	KGF
		Hands-on Training on ARMIS Applications	BSRI	20 April 2016	35	KGF
		Hands-on Training on ARMIS Applications	BINA	25 2016	41	KGF
<i>Manpower & Training</i>	25	Training Workshop on Communications for Policy Research & Impact	BARC	29-31 March 2016	37	IFPRI
<i>Total</i>					1153	

Workshop

Div/ Unit	Sl No	Activity	Venue	Duration	No. of Participant	Funding
Crops		Crop Improvement Programme: Research Progress 2014-15 & Research Programme 2015-16.	BARC	9-10 Aug. 15	75	Revenue
	2	Review Workshop on Crop protection Programme: Research Progress 2014-15 & Research Programme 2015-16.	BARC	05-06 August	140	Revenue
	3	Review Workshop on Crop Production Programme: Research Progress 2014-15 & Research Programme 2015-16.	BARC	2-4 Aug 2015	80	Revenue
	4	Workshop on Biodiversity	BARC	9 Jan 2016	50	FAO
	5	Inception Workshop for “ Capacity Building for Conducting Adaptive Trials on Seaweed Cultivation in Coastal Areas	BARC	24 Jan 2016	55	KGF
	6	AFACI, GAP & Post harvest Workshop	BARC	13/10/2015	50	AFACI
P&E	7	National Workshop on Biotechnology and Molecular Breeding Research in Bangladesh	BARC	14-15 May 2016	70	Revenue
	8	Annual Workshop Review Workshop (Source: BARC)	BARC	27/07/2015	50	Revenue
	9	Sector Leaders Workshop on Preparation and Implementation of Development Projects	BARC	02 Aug 2015	75	Revenue
	10	Field Monitoring Workshop of Research Grant Project (Source: BARC)	BARC	-	100	Revenue
	11	Workshop on Progress Review of Research Grant Projects (Source: BARC)	BARC	1 June, 2016	100	Revenue
	12	Workshop on Understanding and Implementation of SDGs through APA	BARC	18/4/16	50	Revenue
AERS	13	Workshop on Review of Socio-Economic Research Program of NARS Institutes	BARC	2/6/2016	80	Revenue
NRM (Agril Eng.)	14	Workshop on Irrigation and water Management Mature Technologies of NARS Institutes: Present Status and Future Proposition	BARC	01 Day Nov/2015 (14/3/2011 6)	80	Revenue

NRM (Soils)	15	Research Review and Program Planning Workshop of Soils Program of NARS Institutes	BARC	8-10 Aug. 15	80	Revenue
NRM (Fore st.)	16	Review Workshop on Forestry & Agro-forestry Research Activities of different NARS Institute & Universities.	BARC	24-26 May 2016	70	Revenue
Livestock	17	Workshop on the Review of Avian Influenza and its Prevention and Control Measures taken in Bangladesh	BARC	9 June 2016	40	Revenue
Fisheries		of Seaweed in Bangladesh	BARC	07 October. 2015	80	Revenue
Nutrition	19	Workshop on Safe Uses of Pesticides/ripening chemicals in Fruits: Health effects and consumer awareness.	Chapai Nawabganj	5 June 2016	120	Rev.
Computer	20	Workshop on ARMIS: A Tool for Informed Decision Making in Agricultural R&D.	BARC	9 Nov. 2015	42	KGF
		Workshop of AFACI Projects in Bangladesh	BARC	6/7/2015	50	AFACI
		Finance	BARC	28/4/2016	55	Revenue
	23	Annual Evaluation of AFACI Project in Bangladesh	BARC	27/6/2016	50	AFACI
	24	Workshop on "ARMIS Application and it's Operation"	HSTU, Dinajpur	May 29, 2016	110	KGF
Manpower & Training	25	Workshop on CSISA-BD Project Achievements and Review of the Progress of PhD Research under CSISA-BARC Scholarship Program	BARC	16 Aug. 2015	50	IRRI (BD)
	26	Agricultural Media Based Workshop	BARC	29 Dec. 2015	50	Revenue
Total	26				1852	

Seminar

Div/ Unit	Sl. No	Activity	Venue	Duration	No. of Participant	Funding
NRM (Soil) / M&T		Seminar on Urea Saving Spray Technology for Rice Cultivation	BARC	18 Nov 2015	80	Revenue
FAO/ BARC (M&T)	2	Seminar on Zero Hunger Challenges and WFS targets, population level undernourishment and child under nutrition, harmonization with ongoing initiatives to address Food Security, hunger and malnutrition.	BARC	1 st July 2015	70	Revenue
Crops / M&T	3	Seminar on Wheat Blast	BARC	6 June 2016	80	Revenue
MoA/ BARC	4	Seminar on Boro Rice Cultivation through Fry Seeded Method	BARC	9 June 2016	200	Revenue
Total	4	-	-	-	430	

At a Glance: HRD (2015-2016) under BARC Management

SI No	Programs	Program Number	No of Participant		Remarks
			Rev. funded Program	Others funding	
01	Training	25	502	651	14 Rev & 11 other funding
02	Workshop	26	975	877	18 Rev. 8 other
03	Seminar	04	430	-	Rev.
04	PhD (In-country/Rev.)	-	19	5	
05	PhD (In-country/CSISA)				
05	Foreign Training/Workshop/Meeting	-		27	
	Total	55	1926	1560	
	Grand Total		3486		

International Training Workshop on Communications for Policy Research and Impact

The *International Training Workshop on Communications for Policy Research and Impact*, jointly organized by Bangladesh Agricultural Research Council (BARC), International Food Policy Research Institute (IFPRI), South Asia Office (New Delhi) and SAARC Agriculture Centre (SAC), was successfully held during 29-31 March 2016 at the Conference Room of BARC.

Chaired by Dr. Abul Kalam Azad, Executive



Mr. Mohammad Moinuddin Abdullah, Secretary, Ministry of Agriculture attended the inaugural session as chief guest

Chairman, BARC, the program was attended among others by heads of different agricultural research and extension organization including the Director General of Department of Extension(DAE) Mr. Md. Hamidur

Rahman, Director General of Bangladesh Agricultural Research Institute (BARI) Dr. Md. Rafiqul Islam Mandal, Director General of Bangladesh Jute Research Institute (BJRI) Dr. Md. Kamal Uddin, Director of Soil Resource Development Institute (SRDI) Mr. Khandker Moinuddin, Executive Director of Cotton Development Board Dr. Md. Farid Uddin and Director of Agriculture Information Service (AIS) Mr. Mizanur Rahman.

The training program was attended by 37 participants of which six (6) were from India, Nepal and Sri Lanka. Nine Resource persons from home and abroad took part in different sessions in the program. The participants were from the public, private, and NGO sectors including the news media. A broad purpose of the training workshop was to develop policy communication skills of the policy researchers, policy analysts, policy advisors and policy makers. In the closing session while expressing their feedbacks the participants thanked BARC for organizing such an important training and many said this training would obviously help strengthen their skills in policy communications.

Training Government Performance Management

Under the revenue funding a two-day training program on *Government Performance Management (GPM)* was organized by the Manpower and Training Unit during 11-12 June 2016 at BARC in accordance with the instructions of the Ministry of Agriculture. The training program was attended by 50 officers of BARC.

Resource persons were from the Ministry of Agriculture who discussed the topics like Guidelines for Annual Performance Agreement (APA), APA Monitoring and Evaluation, Grievance Redress System, Concept of Government Management Performance System (GPMS), Citizen's/Client's Charter, Innovations for Improvement of Service Delivery

Training on Right to Information Act

A day long training program on *Right to Information Act* was organized by the M&T Unit of the Council on April 12, 2016 at Conference Room-1, BARC. As many as 50 officers of the Council attended the training program. Mr. Nepal Chandra Sarker, Information Commissioner of the Information Commission, Dhaka attended the inaugural session as chief guest. He was also a resource speaker for the 1st session. Dr. Abul Kalam Azad, Executive Chairman of BARC presided over the inaugural session. Other resource persons were from the Ministry of Agriculture and MRDI, an NGO assisting the Information Commission for implementation of Right to Information Act. The training program was implemented in accordance with the decision taken in the Monthly Coordination Meeting of Ministry of Agriculture.

Seminar on CSISA-BD Project Achievements and Review of the Progress of PhD Research under CSISA-BARC Scholarship Program"

A seminar on *CSISA-BD Project Achievements and*



Mr. Mohammad Nazmul Islam, Additional Secretary, Ministry of Agriculture attended the program as chief guest

Review of the Progress of PhD Research under CSISA-BARC Scholarship Program was jointly organized by BARC and IRRI-BD Office, Dhaka on August 16,

2015 at the Conference Room-1, BARC. Five PhD scholars under CSISA-BARC Scholarship Program individually presented brief progress of their PhD studies/research. It may be mentioned that CSISA-BARC Scholarship Program funded by IRRI, CIMMYT and WorldFish under CSISA-BD Project, is being conducted by BARC. Mr. Mohammad Nazmul Islam, Additional Secretary, Ministry of Agriculture attended the program as chief guest. The seminar was presided over by Dr. Abul Kalam Azad, Executive Chairman, BARC and attended among others by the heads of the NARS institutes and representatives/senior officers from CGIAR centres in Dhaka.

Seminar on Boro Rice Cultivation under Dry Seeded Method

As per the instruction of the Ministry of Agriculture a seminar on *Developing a Technology for Boro Rice Cultivation under Dry Seeded Method* was held on June



Begum Matiya Chowdhury MP, Hon'ble Minister, Ministry of Agriculture is addressing the seminar as chief guest

9, 2016. The seminar was presided over by Mr. Mohammad Moinuddin Abdullah, Secretary, Ministry of Agriculture where Begum Matiya Chowdhury, Hon'ble Minister, Ministry of Agriculture was present as chief guest. Dr. Abul Kalam Azad, Executive Chairman of BARC delivered welcome address. Prof. Dr. Md. Moshir Rahman, Agronomy Department, Bangladesh Agriculture University, Mymensingh presented a key-note paper on the above subject. In his presentation Dr. Rahman elaborated the water saving technology for Boro rice cultivation under dry seeded method. The scientists and officers attending the seminar from different agricultural research-extension agencies, universities and other agricultural offices

exchanged their views about the efficacy of this technology.

Visit Abroad

Crops

- Dr. Rina Rani Saha, PSO (Crops) attended the *Second High Level Training on Globally Important Agricultural Heritage System (GIAHS)* under South South Cooperation (SSC) arranged by FAO during 5-19 September 2015 at China. During the training period, participated in several field visit like i) Ningxia Zhongning Medlar Cropping System and Lingwa Jujube Cropping System, Yinchuan ii) Huzou Mulberry Fish Pond System, Hangzhou iii) Qingtian Rice-Fish Culture, Qingtian iv) Xaunhua Traditional Vineyard System etc. A PPT presentation was delivered on *Salient Feature of Proposed GIAHS Site of Bangladesh* and a documentary on Floating Agriculture made by BARI was also showed in the New GIAHS formulation and Action Plan session.
- As the national focal point Bangladesh Dr. Md. Aziz Zilani Chowdhury participated in the *Regional Consultation on The State of Asia's Biodiversity for Food and Agriculture* held at Bangkok, Thailand during 26-28 April 2016. In total 16 focal points from Afganistan, Bangladesh, Bhutan, Cambodia, India, Lao PDR, Malaysia, Maldives, Mongolia, Nepal, Pakistan, The Pilippines, Singapore, Sri Lanka, Thailand and Vietnam were participated in the consultation meeting. A power point presentation was delivered by Dr. Md. Aziz Zilani Chowdhury on *The traditional floating system to the livelihoods of local communities in Bangladesh* which was highly appreciated by the participating countries. Besides this, focal points were participated in three working groups for identifying needs and priorities on i) Assessment and monitoring ii) Sustainable use and conservation iii) Policies, institution and capacity Regional and International Cooperation.
- Dr. Md. Abdus Salam, PSO (Crops) and National Focal Point of ITPGRFA joined in the 6th Session of the Governing body of the International Treaty on Plant Genetic Resources for Food and Agriculture in Italy during 02-10 October, 2015. Bangladesh selected as a member of the *Scientific Advisory Committee on Global Information system on PGRFA* for the Asia region, 2016-17.

- Dr. Md. Korshed Alam, PSO (Crops) participated in the study visit held in India on SAARC GAP Project arranged by FAO, UNDP in collaboration with Quality Council of India (QCI) during 17-23 January 2016.

Forestry, NRM

- Attended Regional Training on Successful Climate Smart Resilient Agricultural Technologies' in SAARC member countries during 16-20 November, 2015 at ICAR, New Delhi, India.
- Participated in the 4th AFACI General Assembly in Colombo, Sri Lanka on May 18, 2016.
- Attended in the "Regional Consultation Meeting on Agroforestry" during 8-10 October, 2015 in India.
- Attended "High level Policy dialogue on Investment in Agricultural Research and Innovation for Sustainable Development in the Asia Pacific" at Bangkok, Thailand during 8-9 December, 2015.
- 1. Participated in the Tropical Agriculture Platform (TAP) and 3rd TAP Partners Assembly on 19-23 January, 2016 in Kigali, Rwanda.

Agricultural Engineering, NRM

- Participated in the 'Seminar on Management of Agriculture for Bangladesh' which was held from 18 November to 08 December, 2015 in Hubei Vocational College of Bio-technology, Wuhan City, Hubei Province, China. In this course, introduced and gathered details knowledge about Chinas agricultural development. We have introduced about Chinas government policies for agricultural development, land reform, agriculture commercialization, mechanization, technology extension policy, soil less crop cultivation, flower expo, management of agricultural pollutions, climate change and agricultural ecology, rules and regulations of bio-safety, food safety issues, genetically modified crops and biotechnological progress and foreign trade policies etc.
- Participated 'Inception Workshop on the Regional Database of Agricultural Mechanization in Asia and the Pacific' which was held in Malaysia during 29-30 March, 2016. Centre for Sustainable Agricultural Mechanization (CSAM), ESCAP organized and coordinated this workshop in collaboration with Malaysian Agricultural Research and Development Institute, Malaysia. The overall objective of the Inception Workshop is to

facilitate mutual understanding on this project, seek engagement and collaboration from member countries and to identify opportunities.

- Participated in the 3rd Regional Forum on Sustainable Agricultural Mechanization in Asia and the Pacific and 11th Session of the Technical Committee of CSAM during 9-11 December 2015 at Manila, Philippine.

Soils, NRM

- Workshop on Basic Agriculture, held in Ho chi Minh City, Vietnam during 18-22 August 2015 and presented progress report of Soil Fertility project under AFACI Program.
- FFTC-APAARI_COA-TDARES Training Course on smart use of Fertilizers to improve crop production and soil conservation held in Taiwan on May 10-16, 2015

Computer and GIS Unit

One officer of this unit attended a Workshop on *ATIN Program Workshop on Extension* during October 20-24, 2015 in Thailand under AFACI Project funding.

III. AGRICULTURAL INFORMATION AND PUBLIC RELATIONS

AGRICULTURAL INFORMATION

BARC devotes considerable efforts and resources for the development of an outstanding library collection to meet the expanding needs of agricultural research and to serve as an information resource centre for NARS institutes.

Development of Collection

Until June 2010 the library has a total collection of about 22,900 information materials, which includes books, reports, pamphlets and bound journals etc. The following information materials have been procured during the period under report:

<u>Items</u>	<u>Quantity</u>
Books and Reports	159
Current Journals/Newsletter	78

Literature Search

The Centre renders literature search services from full-text database - The Essential Electronic Agricultural Library (TEEAL) CD database to satisfy the researchers, agricultural scientists, planners and policy-makers. It also provides search services on specific requests received from teachers, students and users from NARS institutes and other organizations. The library provided search service from TEEAL to 20 external users.

Services and Users

During this period 275 users of different categories have used the library. Besides the BARC and NARS scientists, teachers and students of Universities, NGO and private organizational personnel are the users of this library.

Update and Maintenance of databases

- Database on Books and Reports contains 5,709 records out of which 251 records have been added during this year

- Database on Journals, Newsletters, and Periodicals contains 1110 records and being updated regularly.

News Clipping Services

Newsclipping of 3633 articles (Bangla and English) have been identified, processed in different format, compiled and prepared a content list and preserved in the library for users. One hardcopy has been given to Executive Chairman as reference copy.

Online Archive of Important Documents

Developed a database driven online archive based on Content Management Systems (CMS). The database contains digital contents of non-conventional documents of high archival value (Policy documents, Reports of all kinds, Proceedings and other mimeographs).

Resource Sharing

The library also performs resource sharing activities to serve the scientists. In this period, the library has collected information materials from FAO, BBS, BANSDOC and all NARS institutes.

AIC also has taken photographs of 85 workshops/training/seminars/meetings and supplied 1889 photos in digital form to the concerned divisions and provided 1,06,290 photocopies of official documents, reports, letters, scientific literature etc. under 4,830 requests.

Other activities

- Prepared a good number of reports on Agriculture Standing Committee & Question-Answer including Supplementary, StarMarked and Non-StarMarked Questions by the Parliament Members and Concerned Ministers for 10th Parliament
- Designed, Prepared and distributed Eid, Nabo barsha, New year greeting Cards
- Monitoring research projects, participate as member of different team/committee, prepare speech for chief guest, special guest of different national seminar & master of ceremonies if different seminars and workshops.

PUBLICATIONS

Preparation/Presentation/Publication of Research Articles/Papers

Crops

- Cabbage Postharvest Handling manual October, 2015 in English and Bangla have been developed and published and distributed among postharvest related scientists and officials.
- Tomato Postharvest Handling manual October, 2015 in English and Bangla have been developed and published and distributed among postharvest related scientists and officials.
- Postharvest manual on Mango developed and published through AFACI Head Office, Korea.
- Good Agricultural Practices (GAP) Manual for Tomato Crop, August 2015 in English and Bangla published and distributed among postharvest related scientists and officers.
- Good Agricultural Practices (GAP) Manual for Mango Crop, August 2015 in English and Bangla developed and published and distributed among postharvest related scientists and officers.
- Postharvest Handling of Mango, Banana, Pear, and Strawberry in Asia. April, 2016.

TTMU

- Transferable Technologies of the NARS Institutes for Sustainable Food and Nutrition Security are in Progress. August 2015, BARC, Dhaka.
- Training Manual on Location specific transferable technologies for sustainable food security: Rangpur and Dinajpur region for Agriculture Officers, DAE, 30-31 May 2016.
- Fruits Mother tree Sapling
- Visit Report on Agro Technological Park: 10-12 May 2015.

Livestock

- Novel multiplex-PCR for rapid detection of *Bacillus anthracis* spores present in soils of Sirajganj district in Bangladesh. Progressive Agriculture, 26 (1): 67-70, 2015.

- Genetic characterization of peste des petits ruminants virus circulating in Bangladesh. British Journal of Virology, 3 (4): 115-122, 2016.
- Isolation and characterization of Staphylococcus aureus from raw milk in Bangladesh. Journal of Advanced Veterinary and Animal Research, 2 (1): 49-55, 2015.
- Slaughter Technology of Livestock-Skin Exportation for Enhancing Foreign-Earning. International Journal of Business, Social and Scientific Research, 4(1): 41-49, 2015.
- Polymerase chain reaction and molecular sequencing for characterization of goat genome. Bangladesh Veterinary Journal, 45 (1-4): 11-19, 2011.
- Molecular identification of *Mycoplasma Synoviae* from seroprevalent Commercial Breeder Farms at Chittagong district Bangladesh. (Vet. World-Accepted).
- Isolation and Molecular identification of Infectious Bronchitis Virus from Commercial Breeder Farms at Chittagong district, Bangladesh. (J. Infec. Mol. Biol.- Accepted).
- Detection of pathogenic serovars of Mycobacterium avium infection in layer chicken. (Asian Journal of Poultry Science- Accepted).
- Annual Report 2014-15, October 2015.
- Report on Field Monitoring of Research Projects under Research Grant Fund of BARC (2015-16), May 2016.
- A passive surveillance onto the occurrence of deadly infectious, emerging and zoonotic diseases of livestock and poultry in Bangladesh with their possible remedies. Proceedings of the 3rd International Exhibition/Workshop on Dairy, Aqua and Pet held at Bangabandhu International Conference Centre (BICC), Dhaka, 18-20 February, 2016, pp. 211-214.
- Proceedings of the Workshop on *Workshop on the Review of Avian Influenza and its Prevention and Control Measures taken in Bangladesh* held on 09 June, 2016 at BARC Conference Room no.1, June 2016.
- Two papers submitted in the 5th National Convention and International Agricultural

Conference to be held during 29-30 September, 2016, organized by KIB.

AERS

M.M.U. Molla, S. A. Sabur and I. A. Begum. 2015. Analysis of Growth and Instability of Jute in Bangladesh. *The Journal of Agriculture and Natural Resources Sciences*. 2(2):429-436.

Agricultural Engineering, NRM

- Presented progress report of Soil Fertility project of AFACI Program in the *Workshop on Basic Agriculture* held in Ho chi Minh City, Vietnam during 18-22 August 2015.
- Published Proceedings of Research Review and Program Planning Workshop of Soils Program of NARS Institutes 2015
- Published a book entitled “Retrospective Analysis of Agro-meteorological Information in Bangladesh” under AFACI project

Computer & GIS

- Presentations were made by Director (Computer & GIS) at AFACI-ATIN Program Workshop on Extension, during October 20-24, 2015 in Thailand.
- Crop calendar for 15 crops Jute, Maize, Potato, Mungbean, Mango, Sugarcane, Tomato, Onion, Lichi, Lentil, Brinjal, Chili, Cotton, Guava and Jujube have been published. A total of 90,000 copies of the calendars distributed among DAE, NARS, KGF, relevant division of BARC and other relevant organizations.
- During this period, annual research programme information from NARS institutes were collected, compiled, edited and published “Directory of Annual Agricultural Research Programme of NARS Institutes-2014-15”. Also collected annual research programme information, prepared and published research directory for 2015-16. The activities are done with the fund of AFACI-ATIN project.

AIC

- BARC Annual Report 2012-13 and 2013-14
- BARC Newsletter vol. 14(1), January-March 2016.

IV. ADMINISTRATION AND FINANCE

ADMINISTRATION

Governing Body Meeting

The 3rd Governing Body (GB) meeting was held on 4 February 2016 in the BARC conference room. The meeting reviewed the achievement and implementation of the decision of the Second GB Meeting. The meeting discussed among others the approval of guideline of Agricultural Research Felicitation Award 2015 and reformed/rebuild the promotion and recruitment committee-1, 2, 3 of BARC. Tea research institute present their research and development report.

Executive Council Meeting

The 16th, 17th, 18th, 19th and 20th meetings of Executive Council of BARC were held on 07/09/2015, 23/11/2015, 07/01/2016, 02/05/2016 and 25/06/2016 respectively in the BARC conference room. The 16th meeting considered among others the approval of the recommendation of the promotion and recruitment committee-3, Discussed about Establishment of a Central Institute for Research, Development and Technology dissemination of agricultural engineering activities. A Study team presented a Report for revitalization of Sugar & Molasses industries, and the research proposals and budget of 2015-16 of Bangladesh Tea Research Institute and Soil Research Institute. In 17th meeting, Bangladesh Fisheries Research Institute presents a Report on Bacterial Diseases of Vietnamese Koi and discussed about its Prevention system. The meeting approved the research proposals and budget of 2015-16 of Bangladesh Rice Research Institute and Bangladesh Institute of Nuclear Agriculture and approved reformed/rebuild the promotion and recruitment committee-1, 2, 3 of BARC. In 18th Executive Council Meeting discussed about the distribution of proposed national & international Phd of NATP Phase – II among NARS Institutes. Another discussion occurred about mark distribution of IBA written exam for recruitment of BARC. In 19th Executive Council meeting a report present about Competitive Research Grant (CRG) and Program Based Research Grant (PBRG) of NATP Phase – II project and discussed about its implementation policy. There approved Research Achievement of 2013-14, Research Progress of 2014-15 and Research Programs

of 2015-16 with budget of Bangladesh Agriculture Research Institute. The 20th Executive Council meeting considered among others the approval of the recommendation of the promotion and recruitment committee-2 & 3 of BARC. It also approved the recommendations of the Research Achievement of 2013-14, Research Progress of 2014-15 and Research Programs of 2015-16 with budget of Cotton Development Board.

Appointment/Promotion/Retirement

Mr. Md. Sohrab Hossain has been promoted to Assistant Director (Store) on 27/06/2016.

FINANCE

Bangladesh Agricultural Research Council (BARC) is the apex body of the National Agricultural Research System (NARS) comprising 12 national agricultural research institutes. As per the BARC Act 2012, it has the mandate to develop priorities in agricultural research, allocate resources and function as a coordinating body to improve the overall research activities of the NARS. BARC received funds from Development and Revenue Budgets of the Govt. to conduct its annual mandate activities like research management, coordination, monitoring, evaluation, technology transfer and manpower development. In this respect BARC's Finance Unit prepares the MTBF budget and financial plan of medium term activities and accordingly disburses fund for achievement of the goal. It keeps all the record of expenditure incurred during the year and reports to the Ministries, CAO, IMED, Development Partner and other Govt. Offices in time. It also reconciles the Accounts with CAO to prepare the final accounts which is submitted before the Public Accounts Committee (PAC) of the National Assembly.

Budgeting and Expenditure Control

The government has implemented *Medium Term Budgetary Framework (MTBF)* for all the Ministries including Ministry of Agriculture and its Divisions, Bodies and Corporations since 2005-06. Accordingly, BARC prepared budget in the form of MTBF for Revenue Head and Development Projects and submitted to the Ministry of Agriculture for approval.

Fund Release/Disbursement

BARC makes proposal for the release of fund from the Govt. on quarterly basis as per approved annual allocation of Budget. In the Financial year 2015-2016, BARC received Tk. 2172.82 lakh for Salary and allowances, Core Research, Technology Transfer,

manpower development and operational fund. To implement the activities like core research, technology transfer & manpower development etc. funds were released to the Agricultural Research Institutes (ARI's) and associated organizations according to the budget plan. The overall financial progress made during the FY 2015-16 is as follows:

a. Financial progress under Revenue Budget (Taka in lakh)

Sl. No.	Line items	FY 2015-16		Achievement (%)
		Budget	Expenditure	
1.	Pay of Officer	350.00	329.15	94.04%
2.	Pay of Staff	325.00	307.25	94.54%
3.	Allowances	412.32	395.38	95.09%
4.	Research Expenses	140.00	135.00	96.43%
5.	Manpower Development/Training	112.00	112.00	100.00%
6.	Utility (Water,Elec.,Gas, Tel.)	169.00	169.00	100.00%
7.	Other operational	101.00	97.15	96.19%
8.	Contributory Provident Fund (Govt. part)	62.00	62.00	100.00%
9.	Repair and Maintenance	33.00	32.48	98.42%
10.	Leave Salary & Gratuity	370.00	370.00	100.00%
11.	Capital Expenditure	106.00	105.50	99.53%
	Total	2180.32	2114.91	97%
12.	(-) Self Income	7.50	0.00	
		2172.82	2114.91	

b. Research Programmes/Projects

BARC has implemented 37 numbers of research projects during the year 2015-16 under its scheduled

research institutes and associated organizations. The financial progress of the research activities are as follows:-

Sl #	Name of Institute	No. of Research Projects	Financial Progress (Tk.)
1.	Sylhet Agricultural University	03	12,00,000.00
2.	Bangladesh Tea Research Institute	01	4,00,000.00
3.	Bangladesh Agricultural University	08	32,00,000.00
4.	Soil Resource Development Institute	01	4,00,000.00
5.	Bangladesh Agricultural Research Institute	13	46,00,000.00
6.	Bangladesh Institute of Nuclear Agriculture	01	4,00,000.00
7.	Bangabandhu Sheikh Mujibur Rahman Agril.Univ.	01	4,00,000.00
8.	Bangladesh Jute Research Institute	01	4,00,000.00
9.	Patutakhali Science & Technology University	01	2,77,500.00
10.	Hazi Danesh Science & Technology University	01	4,00,000.00
11.	Bangladesh Rice Research Institute	02	8,00,000.00
12..	Cotton Development Board	01	3,00,000.00
	Total	34	1,27,77,500.00
13.	Bangladesh Agricultural Research Council		7,22,500.00
	Grand Total		1,35,00,000.00

Accounting

BARC's Finance Unit maintained its accounts following standard accounting system. It has kept a well-printed Cash Book, Ledger, Advance Register, Budget Control Register and other related books to record all transaction during the year accurately.

GOB Audit

GoB local audit department not conducted audit for the FY 2015-2016.

Settlement of audit objections

During the year 2015-16 a remarkable number of audit objections have been settled.

SN	Particular	Objection	Amount (Tk)
1.	Revenue	50	3,61,00,000.00
2.	Development	8	2,72,00,000.00
	Total :	58	6,33,00,000.00

Reporting

BARC Finance unit has kept all the record of expenditure incurred during the year and reported to the Agriculture Ministry, IMED, CAO, Development Partner and other Government offices monthly, quarterly, half yearly and annually for revenue and development programmes.

Monitoring and Evaluation

Monitoring and Evaluation are the integral part of an effective planning and performance based budgeting plan became successful and the value for money was realized only when the proposed targets for outcomes/outputs were achieved. To attain the targets, BARC Finance section regularly maintained desk monitoring on the utilization of fund for planned activities including budgetary and expenditure control mechanism.

Reconciliation

BARC also reconciled the Accounts with CAO to prepare the Final Accounts which was submitted before the Public Accounts Committee (PAC) of the National Assembly.

Retirement benefits

During the year 2015-16, retirement benefits and CPF payment made to the Officer's and Staff of BARC are shown below:

a) CPF Final payment

1.	Officer's (10)	Tk. 1,45,98,105.00
2.	Staff (8)	Tk. 32,85,009.00
	Total	1,78,83,114.00

b) Gratuity payment

1.	Officer's & Staff (12)	Tk. 1,27,04,000.00
	Total	1,27,04,000.00

c) **Leave Salary payment:** Leave Encashment allowed to the 10 Officer's and Staff as follows:

1.	Officer's & Staff (10)	Tk. 36,61,000.00
	Total	36,61,000.00

d) **CPF Loan:** CPF loan provided to the Officer's and Staff during the year is as follows:

1.	Officer's (10)	Tk. 33,10,000.00
2.	Staff (49)	Tk. 90,68,500.00
	Total	1,23,78,500.00

e) **Benevolent fund:** Benevolent fund provided to the Officer's and Staff as follows:

1.	Officer's & Staff (22)	Tk. 2,48,000.00
2.	Medical Assistance (3)	Tk. 85,000.00
	Total	3,33,000.00

Income tax: Salary statements have been provided to the Officer's and Staff for payment of Income tax during the year.

Group Insurance

BARC undertook Group Insurance scheme for well being of its Officers and Staff for any unavoidable incident with Jiban Bima Corporation since 38 years.

We mourn at the death of our three colleagues i) Late Nazim Uddin, Sr. Asstt. Director (Procurement) (ii) Late Siddique Mia, Security Guard (iii) Late Abdul Latif, Farash during the year. We received an amount of Tk.12,31,800.00 as compensation under the Group Insurance from Jiban Bima Corporation for the aforesaid deceased and payment made to their nominees accordingly.

Professional Staff

Office of the Executive Chairman

Abul Kalam Azad, PhD, Executive Chairman
Md. Hussyam Uddin Parvez, PS to Executive
Chairman

Crops Division

Md. Aziz Zilani Chowdhury, PhD, Member Director
(Routine Charge)
Mian Sayeed Hassan, Chief Scientific Officer, PhD
S.M. Khorshed Alam, PhD, Principal Scientific
Officer
Md. Abdus Salam, PhD, Principal Scientific Officer
Rina Rani Saha, PhD, Principal Scientific Officer
(Deputation)

Planning and Evaluation Division

Paresh Chandra Golder, PhD, Member Director
Md. Abdul Awal, PhD, Principal Scientific Officer
Kabir Uddin Ahmed PhD, Principal Scientific
Officer

Natural Resources Management Division

Sultan Ahmmed, PhD, Member Director (Current
Charge)
Mohammad Shahjahan, PhD, Chief Scientific Officer
(Forestry)
Md. Abdus Satter, PhD, Chief Scientific Officer
(Soils)
Shaikh Mohammad Bokhtiar, PhD, Principal Scientific
Officer (Soils)
Md. Baktear Hossain, PhD, Principal Scientific Officer
(Soils)
Dr. Nazmun Nahar Karim, PhD, Principal Scientific
Officer (Ag. Engg.)
Dr. Md. Saifullah, PhD, Principal Scientific Officer
(Forestry)

Fisheries Division

Md. Kabir Ikramul Haque, PhD, Member Director

Nutrition Unit

Md. Monirul Islam, PhD, Director

Livestock Division

Shah Md. Ziqrul Haq Chowdhury, PhD, Member
Diretor (Routine Charge) & Chief Scientific Officer

Agricultural Economics and Rural Sociology Division

A.S.M. Anwarul Huq, PhD, Chief Scientific Officer
Mosharraf Uddin Molla, PhD, Principal Scientific
Officer

Technology Transfer Monitoring Unit

Mian Sayeed Hassan, PhD, Director (Additional
Charge)
Fauzia Yasmin, PhD, Principal Scientific Officer

Agricultural Information Centre

Md. Rafique Mostafa Kamal, Director (Additional
Charge)
Md. Abdul Mabin, Principal Librarian (Current
Charge)
Shah Md Monir Hossain, Senior Scientific Editor
Afroza Anjum, Senior Reprographic Officer
Susmita Das, Senior Documentation Officer
Md. Alamgir, Graphic Designer (Current Charge)
Hosne Ara Fersous, Bibliographic Officer (Additional
Charge)

Computer and GIS Unit

Md. Abeed Hossain Chowdhury, Director
Hasan Md. Hamidur Rahman, Senior System Analyst
Md. Shohid Uddin Bhuiyan, System Analyst
Mihir Kanti Sarker, Data Entry Officer
Md. Ayub Hossain, Data Entry Officer
Md. S.M. Shah Alam, Data Entry Officer (Current
Charge)

Manpower and Training Unit

M. Aminuzzaman, Director (Current Charge)
Md. Mustafizur Rahman, Principal Training Officer
(Addl. Charge)

Administration and Finance Division

Paresh Chandra Golder, PhD, Member Director

Support Service Unit

Shaikh Mohammad Bokhtiar, PhD, Director (Addl.
Charge)

Md. Abdul Mottakin, Deputy Director (Establishment)
KM Ali Haider, Assistant Director (Establishment)
Md. Nasir Uddin, Assistant Director (Store)
Dalil Uddin Boshnia, Assistant Director (Common
Service)

Finance Unit

Ajit Kumar Chakraborty, Director (Finance) (Current
charge)
Md. Jashim Uddin Chowdhury, Deputy Director
(Budget)
Md. Mahabubul Hassan, Sr.Asstt. Director (Budget)
Md. Daloar Hossain, Sr. Asstt. Director (Accounts)
Md. Lokman Hossain, Asstt. Director (Audit)

THE GOVERNING BODY
BANGLADESH AGRICULTURAL RESEARCH COUNCIL

1	Honorable Minister for Agriculture	Chairman
2	Honorable Minister for Fisheries and Livestock	Co-Chairman
3	Honorable Minister for Environment and Forests	Co-Chairman
4	Mr. Nazmul Hasan, Parliament Member, Kishoregonj-6	Member
5	Mr. Abdul Mannan, Parliament Member, Bogra-1	Member
6	Secretary, Ministry of Agriculture	Member
7	Secretary, Ministry of Fisheries and Livestock	Member
8	Secretary, Ministry of Environment and Forests	Member
9	Member (Agriculture), Planning Commission	Member
10	Vice Chancellor, Bangladesh Agricultural University	Member
11	Chairman, Bangladesh Agricultural Development Corporation	Member
12	Executive Chairman, Bangladesh Agricultural Research Council	Member
13	Director General, Department of Agricultural Extension	Member
14	Director General, Bangladesh Agricultural Research Institute	Member
15	Director General, Bangladesh Rice Research Institute	Member
16	Director General, Bangladesh Jute Research Institute	Member
17	Director General, Bangladesh Institute of Nuclear Agriculture	Member
18	Director General, Bangladesh Sugarcane Research Institute	Member
19	Director General, Department of Livestock Services	Member
20	Director General, Department of Fisheries	Member
21	Joint Secretary, Finance Division, Ministry of Finance	Member
22	Joint Secretary (Discipline and Law), Ministry of Public Administration	Member
23	Chief Conservator of Forests, Forest Department	Member
24	Dr. M.A. Hamid Miah, Liaison Scientist, IRRI Bangladesh, House#9, Road#2/2, Banani, Dhaka	Member
25	Dr. Qazi Kholiquzzaman Ahmad, Chairman, Palli Karma-Sahayak Foundation, PKSFBhaban, Plot-E, 4/B, Agargaon, Dhaka	Member
26	Professor Dr. M. Nurul Islam, BUET, Flat-7, Minakkhi Apartment, House#27, Road# 12A (New), Dhanmandi, Dhaka	Member
27	Mr. Motahar Hossain Mollah, President, Bangladesh Krishok League, Kapasia, Gazipur	Member
28	Mr. A.K.M. Azad, Proprietor, A.M. Traders, Globe Center, 28/1 Indira Road, Farmgate, Dhaka	Member
29	Dr. Mahabub Hossain, Adviser to Executive Director, Bangladesh Rural Advancement Committee, BRAC Center, 75, Mohakhali, Dhaka	Member
30	Member Director (Administration & Finance), BARC	Member Secretary

THE EXECUTIVE COUNCIL
BANGLADESH AGRICULTURAL RESEARCH COUNCIL

1.	Executive Chairman, Bangladesh Agricultural Research Council, Dhaka	Chairman
2.	Director General, Bangladesh Agricultural Research Institute, Gazipur	Member
3.	Director General, Bangladesh Rice Research Institute, Gazipur	Member
4.	Director General, Bangladesh Jute Research Institute, Dhaka	Member
5.	Director General, Bangladesh Institute of Nuclear Agriculture, Mymensingh	Member
6.	Director General, Bangladesh Sugarcrop Research Institute, Ishurdi, Pabna	Member
7.	Director General, Bangladesh Livestock Research Institute, Savar, Dhaka	Member
8.	Director General, Bangladesh Fisheries Research Institute, Mymensingh	Member
9.	Director, Bangladesh Tea Research Institute, Srimongal, Moulvibazar	Member
10.	Director, Bangladesh Forest Research Institute, Chittagong	Member
11.	Director, Soil Resource Development Institute, Dhaka	Member
12.	Director, Bangladesh Sericulture Research and Training Institute, Rajshahi	Member
13.	Executive Director, Cotton Development Board, Dhaka	Member
14.	Executive Director, Krishi Gobeshona Foundation, Dhaka	Member
15.	Member Director (Crops), BARC	Member
16.	Member Director (Planning and Evaluation), BARC	Member
17.	Member Director (Natural Resources Management), BARC	Member
18.	Member Director (Agricultural Economics and Rural Sociology), BARC	Member
19.	Member Director (Livestock), BARC	Member
20.	Member Director (Fisheries), BARC	Member
21.	Member Director (Administration and Finance), BARC	MemberSecretary