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ANNUAL REPORT 2023

BLRI ANNUAL REPORT 2023

Bangladesh Livestock Research Institute
Savar, Dhaka-1341

ANNUAL REPORT 2023

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Preface

Bangladesh Livestock Research Institute (BLRI) is a state-run research institute at national level for livestock and poultry sector under The Ministry of Fisheries and Livestock, Bangladesh. BLRI has developed 95 Packages and Technologies since its establishment for increasing livestock production. The mandate of the institute is to identify livestock and poultry production and their health constraints, develop solutions through a multi and interdisciplinary research approach and generate technologies compatible with other resources of the farmers to solve those constraints and problems. To address the mandates of the institute, BLRI has been conducting need based research activities in the six different disciplines namely, Animal and Poultry Breeding and Genetics; Feeds, Fodder and Nutrition; Animal and Poultry Diseases and Health; Animal Biotechnology, Environment and Climate Resilience and Waste management; Socio-Economics & Farming System Research. The research projects are implemented each year through a robust review process and finally approved by the Technical Committee to achieve the specific goals as well as SDG's.The Annual Research Review Workshop 2023 is presenting the research activities in the financial year 2022-23 that contained 83 research projects from revenue and developmental budget. A total 83 executive summaries are presented where 49 for oral presentation and rest on 26 for poster presentation in the respective disciplines (remaining 8 projects are yet to be completed) that will help students, scientists, academicians and policy makers for developing future research programs and taking the decisions of development policy in livestock and poultry sector. However, I am very much happy to share you all that BLRI is unwrapping the "Livestock and Poultry Production Technology Manual (4th Edition)" in this ceremony. There are 95 technologies included in this directory that will helpful to entrepreneurs, researchers, academicians, farmers and policy makers who are directly or indirectly involved in livestock production and socio-economic empowerment. The institute is acknowledging the strong support of Ministry of Fisheries and Livestock (MoFL) for the research endeavors and I am also very thankful for active participation of the all participates from the Department of Livestock Services, academia from different universities, scientists from different research institutes, representatives from NGO's, experts from other Organizations who are sharing their expertise during this workshop. The institute highly appreciates all the scientists of technical committee for offering their utmost effort to publish the annual report and other committee members for making this event successful. Finally, BLRI believes that technological innovation through livestock research and development is contributing at all levels of national development, poverty reduction, employment generation, woman empowerment and safe animal protein production.

(Dr. Shakila Faruque)

Contents

Geographical location of BLRI and Regional Station

Mandates and Organizations of the Institute

Mandates

- To identify the basic problems affecting livestock and poultry both at the national and farm levels;
- To solve these problems through multi and inter-disciplinary and inter-institutional research;
- To develop techniques and knowledge for livestock and poultry production to help food and nutrition security for the increasing population, poverty alleviation, employment creation and environment pollution control;
- To train scientists in the appropriate fields of research, at home and abroad, thereby filling the gap of skilled scientists;
- To strengthen research-extension-NGO linkage and expedite quick dissemination of the developed and introduced techniques to the end users;
- To assist the Government and all concerned in policy decisions related to livestock and poultry research and development;
- To impart training to trainers, farmers and front-line extension of livestock technologies to the farmers.

Organization Structure

BLRI has 10 (ten) research divisions, one support service division, 4 (Four) research centres and 5 (Five) regional stations and one is under construction:

Research Divisions

- Animal Production
- Poultry Production
- Animal Health
- Goat Production
- Sheep Production
- Bio-technology
- Socio-economic
- Farming System Research
- Training, Planning and Technology Testing
- Buffalo Production

Support Service Division

Research Centres

- Dairy Research and Training Centre
- Poultry Research Centre
- Transbounday Animal Disease Research Centre
- Climate Resilient Livestock Production Research Centre

Regional Stations

- Baghabari, Sirajgonj
- Nalkhongchari, Bandarban
- Bhanga, Faridpur
- Jashore Sadar, Jashore
- Godagari, Rajshahi
- Saidpur, Nilphamari

Organogram


Ministry of Fisheries & Livestock
Board of Management
Director General
Research Divisions
Support Service Division
Regional Stations
Research Centers
Animal Production Research Division
Poultry Production Research Division
Animal Health Research Division
Goat Production Research Division
Sheep Production Research Division
Buffalo Production Research Division
Farming System Research Division
Socio-economic Research Division
Bio-technology Division
Training, Planning and Technology Testing Division
Administration Section
Security Unit
Transport Unit
Engineering Section
Publication and Public Relation Section
Library Section
Accounts Section
ICT Section
Store and Procurement
Research Farm
Baghabari, Sirajgonj
Naikhongchari, Bandarban
Bhanga, Faridpur
Jashore Sadar, Jashore
Godagari Rajshahi
Dairy Research and Training Centre
Poultry Research Centre
Transboundary Animal Disease Research Centre
Climate Resilient Livestock Production Research Center

Board of Management

The institute is administered by a Board of Management. The Board is the highest making body in the Institute's organizational structure and holds full responsibility determine and execute policies and undertakings of the Institute within the frame of policy directives issued by the Ministry of Fisheries and Livestock of Bangladesh Government. The Director General is the executive head and works on behalf of the Board of Management. The Board of Management, consists of:

Chairman

Hon'ble Minister, Ministry of Fisheries and Livestock.

Vice-Chairman

Secretary, Ministry of Fisheries and Livestock, ex-officio.

Member

- Two Members of Parliament to be nominated by the Hon'ble Speaker.
- Secretary, Ministry of Finance, ex-officio.
- Member (Agriculture), Planning Commission, ex-officio.
- Executive Chairman, Bangladesh Agricultural Research, Council, Farmgate, ex-officio.
- Vice-Chancellor, Bangladesh Agricultural University, Mymensingh, ex-officio.
- Director General, Department of Livestock Services, ex-officio.
- Two persons to be nominated by the Government from among persons having interest in Livestock and poultry.
- Two persons to be nominated by the Government from among persons engaged in research activities in the institute.

Member Secretary

Director General, Bangladesh Livestock Research Institute.

Technical Committee

The Technical Committee (TC) is an advisory body which provides professional input, scrutinizes and reviews the technical aspects of research programs including research budget and recommend for final approval to the Board of Management. The TC is composed of multidisciplinary and inter-institutional experts with the following members:

- **Director General** — **Chairman**
  Bangladesh Livestock Research Institute
- **Dean** — Member
  Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh
- **Dean** — Member
  Faculty of Animal Husbandry, Bangladesh Agricultural University, Mymensingh
- **Dean** — Member
  Agricultural Economics and Rural Sociology, Bangladesh Agricultural University, Mymensingh
- **Member Director (Livestock)** — Member
  Bangladesh Agricultural Research Council (BARC)
- **Representative (Specialist)** — Member
  Climate Resilient, Ministry of Environment
- **Representative (Specialist)** — Member
  National Institute of Biotechnology, Gonokbari, Savar, Dhaka
- **Representative (Director)** — Member
  Department of Livestock Services (DLS)
- **Director (All)** — Member
  Bangladesh Livestock Research Institute, Savar, Dhaka
- **Additional Director** — Member
  Support Service Division, BLRI
- **Head (All Research Division/ Project Director)** — Member
  Bangladesh Livestock Research Institute, Savar, Dhaka
- **Representative (Former CSO)** — Member
  Bangladesh Livestock Research Institute, Savar, Dhaka
- **Director (Research)** — Member- Secretary
  Bangladesh Livestock Research Institute, Savar, Dhaka

Director (Research) Office

Development of feeds and fodder date base for efficient feeding system for livestock production

Feed is the fundamental and cost-involved item of efficient livestock farming. It relates directly to the farm economy. It is very important to prepare area wise local feed inventory and determination of their nutrient composition to reduce the feed costs of the dairy farms. The present research was designed to establish a national feed inventory and an online-based animal feed resources knowledge hub (data bank) for livestock production. A baseline survey was conducted through personal interviews with farmers. A total ten (10) Upazilas's (Manikgonj, Munshigonj, Jeshore Sadar, Jhikorgacha, Patiya,Naikhongchori, Charfashion, Madarganj, Godagari, Ishwardi) from six different divisions the survey, sample collection and analysis was completed. This year, survey and sample collection has been completed in 7 (seven) upazilas and sample analysis is underway. Different types of local grass have been collected from different upazilas among them bottle grass, paccha, chauchra, unknown hydrid, hechi grass, Rana, Jangra, Kolmi etc is remarkable in Patuakhali district. Chronologically, all upazila's from all the divisions of Bangladesh will be included in this study. The collected sample was analyzed for proximate composition (DM, Ash, CP, EE, NFE, CF, ADF, NDF, lignin), energy (GE, ME) and mineral component's (Ca, P) from DLS and SRDI. To achieve the other objective, an ICT company named Softcell System was hired to design a website and the name is "BLRI Feeds and Fodder Data Bank". All food ingredients, both locally and commercially, were collected, analyzed and data were checked by animal nutrition experts in Bangladesh and then documented on an online webpage. An interactive and user-friendly online feed database for all stakeholders along with a least-cost ration formulation facility for farmers will be developed. A comprehensive database of all kinds of feed resources, along with their nutrient composition and nutritive value for academia, scientists, businessmen, and farmers (especially educated farmers) will be developed.

Improvement of feeds and fodder for development of roughage-based feeding strategy for dairy and beef cattle production

The present study was undertaken to develop region-based fodder calendar including fodder production system and roughage based low-cost feed. A field survey was conducted in different areas (7 Upazilas namely *Godagari, Nachole, Sirajgonj, Bhanga, Saltha, Patuakhali and Kalapara*) of Bangladesh for collecting the information about existing livestock status, agricultural cropping pattern, available feeds and fodder, feeding practices and manure management system. Results indicate that,

the cattle farmers do not follow a standard feeding system due to lack of information on the nutrient composition of feed ingredients and scientific knowledge to formulate balanced rations. The region and season based available feeds and fodder were also identified from the survey. A study was undertaken to assess the feasibility of Mung bean hay production for animal feeding in Barishal Divison. After that, a total of 10 farmers were selected of which 5 (five) farmers were considered as control for regular mung bean grain production and 5 (five) farmers were selected for mung bean hay production. The Gross Margin and BCR of mung bean hay production group was BDT 109597.85 /ha and 2.04 higher than control pulse production group BDT 63502.02 /ha and 1.18, respectively. The cost of production was also lower in mung bean hay production (11.52 Tk/kg) than mung bean grain production group (36.69 Tk/kg). In the fiscal year 2022-23 a total of 2.5 lakh fodder cuttings of BLRI Napier-3, Napier Pakchong, German, Jara, Jamboo and Red Pakchong were distributed at Barishal among the 107 selected farmers covering 3050 decimals land. A total of 361 (New) farmers started fodder production by getting motivation and fodder cutting support from previous 82 fodder farmers (BLRI provided fodder cuttings support to 82 farmers in 2021-22). It was found that the fodder cultivation land increased by 14.54% or 2.47 times than baseline survey at Barisal Division. Besides these, five types of hybrid Sorghum were collected from Lal Teer Seed and cultivated at research farm of BLRI to evaluate the production quantity and quality. The highest biomass yield was observed in forage sorghum (27.27 ton/ha) at 45 days and forage pearl millet (60.29 ton/ha) at 60 days.

Development of a TMR based feeding strategy for dairy cattle

The present study was undertaken to formulate various composition of TMR using different regional and seasonal feed ingredients and the evaluate nutrient composition, shelf-life and feeding value of the formulated TMR. Locally available feeds and fodder were identified from the Barishal division through a survey activity. Farmers use Maskalall, Khesarl, Soybean, and Groundnut straw as cattle feed. Mung bean was cultivated in the Barishal division and after harvesting the Mung bean grain, farmers sold the residue of Mung bean at 15Tk/kg, which is named hay. Maize Stover was collected from Rangpur Division. Moringa mash collect from BLRI Research Farm for TMR preparation. Besides this, Soyabean meal, Mustard oil cake, Wheat bran, Maize crush, molasses and DCP were used to prepare TMR. The straw residue of Maskalall, Khesarl, Soybean, Groundnut straws was collected from Barishal division.

After collection, all feed ingredients were chopped, ground or milled. The nutrient composition of different feed ingredients observed the highest CP content in mung bean hay (17.23%) followed by moringa hay (16.53%). In case of straw of different leguminous fodders, the highest CP was found in Maskalai straw (11.61%) followed by Khesari straw (8.46%) and Groundnut straw (8.35%) and the lowest CP was 4.38% observed in Soybean straw. After nutritional evaluation TMR were prepared using the locally available roughage and concentrates at a ratio of 30:70, 60:40 and 45:55 in TMR_1, TMR_2 and TMR_3 for Barishal region. The Dry Matter (DM) content was 86.81%, 88.49% and 87.95%; Crude Protein (CP) content was 16.12%, 16.11% and 16.49%; and Metabolizable Energy (ME) was 11.34 MJ/Kg, 10.63 MJ/Kg and 10.28 MJ/Kg in TMR_1, TMR_2 and TMR_3 respectively. Parameters like shelf-life, DM (before & after), Proximate, Lactic acid, Acetic acid, Ethanol, IVDMD,OM, Fiber, Energy, Mineral and maximum temperature at 15days interval up to 120 days will be determined and the project is on-going.

Animal Health Research Division

Development of duck plagues vaccine seed from circulating strain

Duck plague (DP) or duck viral enteritis (DVE), caused by the alpha herpes virus, is an acute, highly contagious viral disease of ducks, geese, and swans of all ages. It is a World Organization for Animal Health (WOAH) listed, notifiable transboundary animal disease. In Bangladesh, DP was first confirmed in 1980, and since then, a significant number of ducks died each year, mainly in Haor areas due to DP. Consequentially, huge economic losses occur annually. Livestock officials in Bangladesh have expressed great concern over the outbreaks of DP. Vaccination is the only well-known method for controlling DP. To efficiently combat this threat, mass production of quality DP vaccine is required. Hence, the present study was executed to isolate and characterize the circulating DPV from field samples and to adapt the virulent DPV strain in a developing chicken or duck embryo for the development of a live attenuated vaccine. A total of 90 suspected DP field samples (liver 30; intestine 30; and spleen 30) were collected. Out of 90 samples, 30, 27, 12 and 21 were collected from Kishoreganj, Netrokona, Savar, and Sunamganj, respectively. All samples were processed and subsequently DNA was extracted using a commercial DNA extraction kit according to the manufacturer's protocol. Conventional PCR was performed targeting the DNA polymerase and gC gene of DPV (OIE, 2017) and found 27.77% (25/90) samples were positive for DPV. The expected PCR amplicon appeared at 446 bp and 78 bp in DNA polymerase and the gC gene, respectively (Fig.ure 1). Organ-wise, DPV recovery rate was higher in the liver (36.66%), followed by the spleen (26.66%) and intestine (20%). Then, all PCR positive samples were inoculated into a 10-day-old embryonated chicken (ECE) and observed regularly until 6 days of post-inoculation (dpi). Then, chorioallantoic membrane (CAM) and allantoic fluid (AF) were harvested and confirmed by PCR. For the isolation and propagation of the DPV, at least three serial blind passages were continued on ECE, and confirmed by PCR, and stored at -80°C. In addition, we are trying to grow and adapt the previous DPV isolates in CEF; besides, we are trying to collect the DF-1 cell line from ATCC (USA) for the adaptation and attenuation of DPV for the development of a DP vaccine.

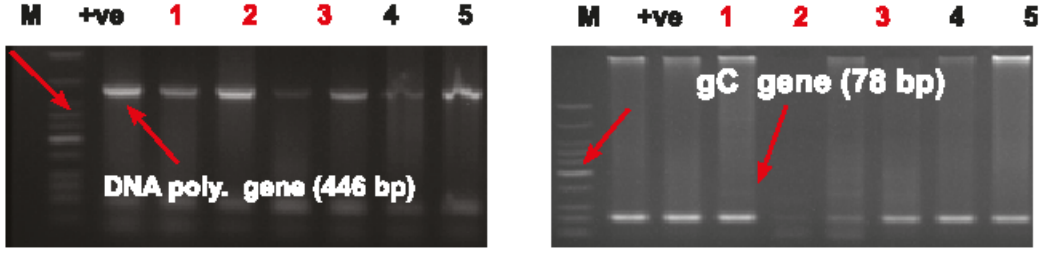

Fig. Amplification of the portion of DNA polymerase (left) and gC (right) gene from duck plague virus. Lane M: 50 bp ladder; Lane 1: positive control; Lane 2-6: field samples.

Monitoring and evaluation of peste des petits ruminants (PPR) virus isolates circulating in Bangladesh

Peste des Petits Ruminants (PPR) is a highly fatal contagious viral disease of small ruminants, mainly in goats and sheep. It is a WOAH-listed transboundary disease of small ruminants. In Bangladesh, PPR was first detected in 1993 in the Meherpur District of Bangladesh, and since then, enormous economic losses occur annually. The FAO and the WOAH jointly initiated the strategic plan for the control and eradication of PPR globally by 2030. The Bangladesh government has also taken initiative since 2017 for the eradication of PPR by 2027. Sero-monitoring of this disease from different geographical locations may help in formulating effective and appropriate control strategies under the ongoing PPR control and eradication program. The present study was conducted to monitor the PPR control program in the selected areas of Bangladesh, detect and characterize PPR virus (PPRV) from PPR disease outbreaks, and maintain a PPRV repository at SAARC PPR laboratory. For sero-monitoring, a total of 681 serum samples were collected from vaccinated goats (> one year) and unvaccinated kids (between 2-3 months) in Jashore (n =145), Rangpur (n=145), Chuadanga (n=131), Rajshahi (n=130), Dhaka (n=130) and then checked by c-ELISA. Besides, 78 suspected PPR field samples (swabs, tissues, and feces) were collected from Jashore (n=27), Rangpur (n=15), Chuadanga (n=16), Mymensingh (n = 12), and Dhaka (n=8) and PPRV was detected by RT-PCR (OIE, 2017). Primary lamb testis cells (LTC) was prepared from the testis of 1–7-day-old lambs. Inoculum was prepared (OIE, 2017) from RT-PCR-positive field samples and inoculated into LTC for PPRV isolation. In sero-monitoring, overall 69.3% (472/681) samples were antibody-positive against PPR disease. According to sex, 71.2% (178/250) and 74.6% (209/280) samples were antibody-positive for PPR in male and female goats, respectively. Alternatively, in unvaccinated kids between 2 and 3 months of age, 56.3% (85/151) of the samples were antibody-positive for PPR. In the PPR outbreak investigation, 37.18% (29/78) field samples were found to be PPRV positive by RT-PCR targeting the N and F genes. The expected PCR amplicon was 448 bp for the F gene and 352 bp for the N gene (Fig.) of PPRV. For the isolation propagation of PPRV, at least five serial blind passages were conducted on LTC and observed CPE regularly. Ongoing research and monitoring of the virus are necessary for understanding the epidemiology of the PPRV and developing effective control strategies.

Fig : Confluent cell monolayer of LTC (left) and cytopathic effect on LTC (right) at 7 days of post inoculation (dpi).

Surveillance and molecular evolution of avian influenza virus in Bangladesh

Avian influenza is a highly contagious viral disease and it is causing tremendous economic losses to the poultry industries over the last decade. As of June 2023, a total of 548 outbreaks of HPAI H5N1 have been reported. The ongoing study aims to examine the objectives- detection, isolation and molecular evolution of avian influenza virus circulating in Bangladesh, and development of reference antisera from circulating A/H5N1 Clade 2.3.2.1a. To achieve the objectives, the research activities in the FY 2022-23 were considered as sample collection from commercial farms and outbreak investigation, then subtype determination by RT-qPCR. AIV antigen was prepared from the isolated A/H5N1. Finally, an antigenic cartography was performed against the current circulating A/H5N1virus. A total of 151 (Oropharyngeal swabs, and PM) samples were collected (from commercial chicken farms in Gazipur, Dhamrai and Rajshahi), labeled and placed to the NRLAI, and stored at -80 °C. Samples were tested and evaluated for the presence of AIV and its subtypes. The samples were screened first for the presence of the M gene by RT-PCR test using reference primers. A total of 27 (17.88%) positive AIV samples were analyzed for AIV subtypes like H5, H9 and other combinations of H5 and H9 subtypes. Among them, 6 H5 and 14 H9 subtypes were identified. Highly positive 3 H5 samples were cultured in SPF chicken eggs and Isolated H5 virus was re-confirmed by RT-PCR test. For the development of reference antisera from circulating H5N1 Clade 2.3.2.1a. A total of 10 AIV sero-negative chickens were selected and infected by formalin killed A/Chicken/Bangladesh/NRL-AI-8323/2017 and A/Chicken/Bangladesh/NRL-AI-2214/2022 virus. Then booster dose was given after 30 days of 1st inoculation. Finally, prime sera and boosted sera (30 days of 1st infection) were collected for further A. cartography study according to standard protocols. Therefore, a total of 8 antigens including two reference antigens of H5N1 and H5N6 were used for the cross-HI test. Then the Cross-HI test of the developed national antisera with reference antigen and local antigen. In antigenic cartography, it was found that the circulating A/H5N1 virus from 2023 is antigenically close to the 2019 virus. In conclusion, diverse antigenicity is noted in circulated HPAI in Bangladesh. So, it is needed to monitor HPAI regularly for its prevention and control.

Genomic mapping and elucidating the antimicrobial resistance pathogens evolution in companion and farm animals

The increasing global threat of antimicrobial resistance (AMR) primarily studied in human clinical settings overlooks its presence and spread in non-human environments like food and companion animals. This study explores AMR in companion and farm animals, aiming to uncover the mechanisms of antimicrobial resistance gene (ARG)

dissemination across different locations. A total of 220 samples (50 cats, 50 dogs, 20 from environments linked to companion animals' hospitals, 56 cattle, and 44 from farm environments) were collected across regions (Chattogram, Dhaka, Barishal, and Rajshahi) in Bangladesh. Microbiological and molecular assays, including PCR, were employed to identify zoonotic bacterial pathogens like *Escherichia coli* and *Staphylococcus* spp. Results indicated 67% and 32% prevalence in cats, 36% and 19% in dogs, 37% and 53.5% in cattle, 54% and 19.3% in companion animals' hospital settings, and 36% and 55.5% in farm environments, respectively. Antimicrobial sensitivity tests, following CSLI guidelines, were conducted against 25 antibiotics for *E. coli* and 17 for *Staphylococcus* spp. *Staphylococcus spp.* isolated from cats exhibited 100% resistance to Linezolid, Levofloxacin, Clindamycin, Tetracycline, Ampicillin, Pen G, and SXT. Similar resistance patterns were observed in dog samples and environments linked to companion animals' hospitals. Cattle isolates showed 75-100% resistance against various antimicrobials. *E. coli* isolates from cattle were 100% sensitive to certain antibiotics but exhibited varied resistance, especially to cephalosporins. Dogs and cats showed highest resistance to Aztreonam (84% and 83%), SXT (83.3% and 66.7%), and Cefotaxim (33.3% and 50%). Environmental samples displayed highest resistance to most antibiotics, except nitrofurantoin, azithromycin, meropenem, and Imipenem, which showed the highest sensitivity against all isolated *E. coli*. While the molecular study is ongoing, this research anticipates the circulation of multi-drug resistant *E. coli* and *Staphylococcus* spp. in companion animals and their environment. This presents a potential transmission risk to animals, humans, and the environment, raising significant public health concerns.

Animal Production Research Division

Assessing baseline status, and knowledge, service and technology need of livestock farmers in selected saline and drought affected areas

The coastal area of Bangladesh suffers from salinity, mainly in dry season (October to May) while the North-western regions are affected by drought in the same time. Livestock affected by salinity and drought through scarcity in drinking water, water for irrigation and farm operation. Indirect effects are mainly mediated through negative effects on crop production, health issues, and reproductive problems in long-term. This research was conducted to assess the baseline status, and knowledge, service and technology need of drought and saline affected livestock farmers in selected regions. Total 200 farmers were interviewed directly from Dacope, Khulna; Shyamnagar, Shatkhira for saline and Godagari, Rajshahi and Nachole, Chapainababgonj for drought region, respectively. A pretested questionnaire was used to collect data. It was found that cattle is the most severely affected species by both salinity and drought compared to others. In adverse time period in both salinity and drought region FMD, LSD, Duck Plague and Newcastle Disease were found to affect intensely. Very severe salinity was experienced from November to May (intensity level 4.3) and farmers face economic loss of 8537 Tk/farm during that period. On the other hand, drought affected mostly from April to May, with an intensity of 4.6 (Very severe) and loss of 10004 Tk/farm. The supply and price of different feed ingredients were affected. Green grass supply was reduced and straw supply was increased. The cultivation cost of fodder, and cut and carry green grass from furthest area resulted in increase of price. To increase resilience against hazard farmers thought they intensely needed suitable technology support, training, feed support and supply of water for drinking, irrigation and other farm use. Therefore, climate-smart resilient technologies, together with hands-on training of farmers are recommended for supporting livestock farmers to increase their resilience against salinity and drought.

Conservation and Improvement of Native Cattle

The present study was undertaken to consider the following objectives: I) to characterize Munshiganj (MC) and North Bengal Grey (NBG) cattle phenotypically and genetically, ii) to study the distribution pattern, density, population size, and phenotypic characteristics of NBG and Netrokona Black Cattle (NBC) in the surveyed area (*in situ*). The data were analyzed using SPSS 25.0. A baseline survey was performed with a pre-tested questioner to determine the availability of NBG and NBC in selected areas of Rajshahi, Naogaon, Bogura, Joypurhat, Rangpur, and Netrokona districts. Generation of calving and calving parity did not affect ($p > 0.05$) TLL, TMY,

DMY, SPC, and average values were 184±10.36 d, 544±47.65 Kg, 2.89±0.16 Kg, and 1.2±0.05 nos.,. The composition of milk fat ($p<0.001$) has an effect on parity and the generation of MC. The average milk fat, protein, SNF, and lactose were 5.98, 3.26, 8.84, and 4.86% in MC. This year, two MC cows were procured from their habitat. A total of 349 NBGs were found in four districts. Most of the morphometric parameters were significantly affected by the region of NBG at adult age. The average BWT, BL, HG, WH, TLL, DMY, PPHP, and SPC of NBG were 177±3.98 Kg, 41±0.66, 51±0.95, and 42±0.36 inch, 228 d, 1.36 Kg, 94 d, and 1.32 nos., respectively. It was revealed that NBC found 146 out of 431 in Netrokona to investigate the distribution of color pattern on coat, skin, muzzle, eye, eyelid, hoof, and tail switch color in male and female were black in most of the cases. The proportions (%) of NBC, Deshi, and crossbred were 33.95, 61.16, and 3.25, respectively. Average TLL, DMY, PPHP, and SPC of NBC were 200 days, 1.11Kg, 64 days, and 1.0 nos., respectively. The productivity of MC, NBG, and NBC can be increased by using a community-based breeding program with farmers' participation.

Fig.1 Netrokona Black Cattle (Male)

Fig.2 North Bengal Grey Cattle (Male)

Assessment of supplementing maize grain with best management practice (BMP) of Napier grass on intake, digestibility and growth performance of RCC bulls

The study was conducted at Cattle Research Farm, BLRI, Savar, Dhaka to assess the effects of supplementing crushed maize with BMP Napier grass (Pakchong) on the intake, nutrient utilization, and growth performance of RCC bulls. Total 20 RCC bulls (average live weight 260 kg) ageing between 28 to 32 months were selected and divided into four dietary groups having five animals in each. Group T_0 were fed control diet consisting of sole 100 cm Napier grass (containing 14-15% CP and 12-13% DM) at *adlibitum*. The animal under T_1, T_2 and T_3 group were supplemented crushed maize at a level of 0%, 0.5% and 1%, respectively of total live weight with 100 cm BMP of

Napier grass. T_1, T_2 and T_3 groups, excluding the control group, were administered same quantities of salt, limestone, and vitamin-mineral premix. The experiment continued for a total of 120 days, which encompassed a seven-day digestibility trial. Results obtain from the study revealed that the T_3 group exhibited a significant rise in dry matter (DM) intake, organic matter (OM) intake, and crude protein (CP) intake, with the addition of 1% crushed maize of animal live weight ($p<0.001$) relative to the other groups. However, an opposite pattern was observed in relation to ADF consumption, as there was a substantial increase ($p<0.01$) in the crushed maize. In terms of metabolisable energy (ME) intake, the T_3 group exhibited the highest value (40.2 MJ kg/day), which was roughly twice as much as the control group ($p<0.01$). A comparable pattern was noted in terms of metabolizable protein intake (MPI), with the greatest value (218 g/day) being recorded in the T_3 group ($p<0.01$). The increase of crushed maize to the BMP of Napier grass, DM digestibility and CP digestibility increase linearly (R2=0.97) and T_3 group shown the greater ($p<0.001$) live weight gain (675 g/day) followed by T_2 group (600 g/day), T_1 (404 g/day) and T_0 group (335 g/day). The average feed conversation ratio (FCR) for T_0, T_1, T_2 and T_3 groups were 9.75, 8.32, 12.3, and 11.2 ($p<0.001$), respectively. These findings suggested that, as such feeding sole BMP Napier (100 cm) is profitable for beef production. However, supplementation of grain with 0.5% of live weight may also be profitable as considering to less requirement of days to achieve 1 Kg live weight.

Fig: Some views of the experiment

Field validation of stress tolerant mutant lines of fodder developed by BLRI

A series of experiment was conducted for development of new stress tolerant fodder variety by using seven Napier cultivars. After the salt screening test, on-station experiment and on-farm validation trial salt tolerant Napier (BLRI grass -5) showed good performance in saline prone region. In relation of that nurseries were established at Shyamnagar, Satkhira and Koyra, Khulna, as part of the on-farm activity. A 5×3 (Variety× Plant Height) factorial design was followed to compare the performances of stress tolerant mutant lines (Pakchong 20, Pakchong 60, Pakchong 90, Napier 4 and Napier 1) of Napier fodder at different plant heights (50, 100 and 200 cm). A

total 8 Pabna growing bulls were randomly divided into two equal dietary groups (T_1 & T_2) to evaluate the feeding effect of salt tolerant Napier (BLRI grass-5) under on station condition. Group T_1 was considered as control offered sole Pakchong (Napier) grass and animals under T_2 groups were supplied BLRI 5 (Salt tolerant) grass. The experiment was continued for a period of 120 days including a 7 days digestibility trial. At on-farm, a total 3 local bulls were fed BLRI 5 (Salt tolerant) grass for a period of 50 days to evaluate the feeding impact of salt tolerant Napier (BLRI grass-5) grass. The animals were weighed at an interval of 10 days, and their feed intake, FCR, growth performances were recorded for both feeding trial. The results revealed that Fresh biomass yield ($p<0.05$), DM yield ($p<0.05$) and CP yield ($p<0.005$) Ton/Ha/cut of different Napier variety differ significantly and highest Fresh biomass yield, DM yield and CP yield observed for Pakchong 60 variety 40.6, 6.26 & 0.87 Ton/Ha/cut, respectively. In case of plant height, the DM and CP percentage of different Napier variety differ significantly ($p<0.001$) and highest CP percentage was observed when grass cut at 50 cm height (17.9%) followed by 100 cm height (15.3%) and 200 cm height (12.8%). The CP ($p<0.05$) intake of bulls vary significantly between the treatment groups but the DM and OM intake was not significantly ($p>0.05$) differ between the groups at on-station. The DM and CP digestibility did not differ significantly ($p>0.05$) between the groups. However, animals fed BLRI 5 grass had higher ($p<0.05$) average daily gain of 0.12Kg compared to 0.0.09 Kg of the animals feeding Pakchong grass. The results of on-farm study revealed that Fresh Intake (Kg/d), DMI (Kg/d), DMI (Kg; % LW) and CPI (Kg/d) of local growing bulls were 20.9±0.04, 3.20±0.02, 1.81±0.01 and 0.43±0.01, respectively. Establishment of nurseries enables distribution of salt-tolerant Napier (BLRI Grass-5) cuttings to the farmers. The study's findings made it evident that the defoliation height and harvesting age of fodder affect its nutritional value and among the various Napier varieties, Pakchong holds the highest ranking in terms of both biomass yield and nutrient quality. Salt-tolerant Napier (BLRI grass-5) has no negative effects on cattle's ability to produce beef.

Fig: Fied validation of stress tolerant mutant line fodder

Production and utilization of Gelatin from bovine hides

The present study was undertaken to determine the present scenario of hides and also extraction of Gelatin from hides pretreated with different level of acetic acid. At first a field study was conducted in three (03) selected areas (Savar, Dhaka & Mymensingh) to know the socio-economic condition of butchers, price of hides, their uses etc. Proximate composition of hides were measured then Gelatin was extracted, where hides treated with 1% acetic acid considered as T_1 group, 3% acetic acid considered as T_2 group & 5% acetic acid considered as T_3 group and each group/ treatment containing three replications. Data were analyzed statistically in an ANOVA of a CRD and the means were compared using DMRT. Butchers overall age was 42.60 years. 59.3% butcher had secondary level of education and 94.40% butcher had solely depend on meat processing. Selling price of a small size hide was Tk. 285.00-443.00, medium Tk. 518.00-758.00 and for large size Tk. 744.00-1515.00. Raw hide's pH were 7.82 and contained 64.14% moisture, 35.86% DM, 30.45% CP, 99.68% OM. Curing with different concentrations of acetic acid was significantly affected ($p<0.001$) the Gelatin yield. The highest yield in terms both wet and dry tissue basis was found in T_3 (16.98% & 47.33%) group followed by T_2 (13.99% & 39.00%) & T_1 (11.57% & 32.27%) group, respectively. However, the chemical composition of Gelatin like moisture, CP, crude fat, OM & ash content did not differ significantly ($p>0.05$) among the treatment groups. The CP content varied from 95.97% to 97.38% and was highest in T_2 (97.38%) treatment group and then that of T_3 (96.49%) and T_1 (95.97%) group, respectively. The Gelatin strength/bloom was differ significantly ($p <0.001$) among the treatment groups. The highest bloom was found for T_2 (205.52g) treatment group as compared to group T_1 (154.90g) & T_3 (195.52g). The highest ($p<0.001$) viscosity was in T_2 (7.04 cP) treatment group than that of T_3 (6.77 cP) & T_1 (6.02 cP) respectively. The color of Gelatin also varied significantly among the treatment groups. The production cost/kg Gelatin were Tk. 742.38, Tk. 790.00 & Tk. 909.00, respectively for T_1, T_2 & T_3 groups.

Fig: Pictorial views of gelatin production

Strategic development of beef breed(s) in Bangladesh

Beef is one of the greatest sources of animal protein and has a great demand in Bangladesh. To meet the growing demand of this protein, beef production of the country must be increased many folds. Considering the above facts, the present research program was undertaken to select the suitable beef sire (s) for crossing with native cattle which will able to produce at least 200.0 kg of carcass within 2 years of age under on farm feeding and management condition. For this, the cows of BLRI Cattle Breed 1 (BCB-1) were inseminated by the imported frozen semen of Brahman, Simmental, Charolais or Limousin. A total of 101 F_1, F_2 and F_3 crossbred progeny of different beef genotypes were produced during the period of 2015 to 2023. At present 50 crossbred are available at BLRI cattle farm and raised under similar feeding and management condition All type of productive and reproductive data were recorded and analyzed by using "agricolae" package of R software (version 3.5.1). After performance evaluation of F_1 progeny, Simmental and Charolais crossbred were selected for production of F_2 progeny through *inter-se* mating. Irrespective of sex Simmental cross showed the highest live weight (542.33±74.52 kg), average daily gain (0.55±0.10 gm), carcass weight (313.06±45.40 kg), meat-bone ratio (4.98±0.18) and HDL (157.19±19.80 ug/g) among the other three crossbred genotypes. Feeding trails with crossbred progeny of Simmental and Charolais crosses were conducted and found significant differences at market age between F_1 &F_2 progeny. The F_2 progeny of Simmental cross showed better FCR than F_1 progeny that may be due to management and less sample size. In the last year (2022-23), a total number of 5211 frozen semen straws of different F_1 crossbred bulls were produced and stored for further research purposes. Based on the findings, it can be stated that Simmental crossbred showed the best performance among the studied genotypes. Production and evaluation of market beef cattle by using BLRI developed assorted beef bulls through field trial will be conducted. Thus, high yielding beef breeds of 75%, 50% and 25% genetic levels are yet to be produced to calculate their precise performance and achieve the goal.

Biotechnology Division

Establishment of semen bank for BLRI improved germplasm
Sub-Title: Development of cost effective semen cryopreservation technique for Indigenous Buffalo and goat of Bangladesh

Fig. : Procedure of semen dilution

This study aimed to determine the most effective diluent for cryopreserving buffalo and goat semen. At first, the best semen cryopreservation technique for indigenous Buffalo and Goats was developed. Five (05) breeding buffalo bulls and five bucks were selected and trained for semen collection. Semen was cryopreserved using different diluters (Triladyl, Steridyl, Andromed, BLRI Tris-egg yolk and traditional Tris-egg yolk diluter). Semen was collected by Artificial Vagina (AV) method, and semen quality was evaluated using CASA after cryopreservation. For data analysis, a two-way Analysis of Variance (ANOVA) was used and results were expressed as standard error of mean (SEM) error using the SPSS program (version 20.0) and the difference between the mean was determined using the Duncan method. It was found that there was a highly significant effect on different diluters. The motile motility rate of buffalo semen using BLRI-Tris, Trad-Tris, Triladyl, Steridyl and Andromed were 76.97%, 54.0% 74.74%, 76.43% and 43.83%, respectively. Although the motility rate of semen using BLRI- Tris and Steridyl diluter was almost same but the semen straw production cost was lower in BLRI-Tris diluter then Steridyl diluter. The conception rate of cryopreserved buffalo semen using BLRI-Tris diluter was 83.33% whereas In Steridyl diluter it was 66.67%. The motile motility rate of goat semen using BLRI Tris-egg yolk, Trad.- Tris egg yolk, Andromed and Triladyl were 77.4%, 73.65%, 66.72% and 53.10%, respectively. The conception rate of goat semen using BLRI-Tris diluter was 79.62%. BLRI. Higher motility and conception rate (76.97% and 83.33%) in Buffalo semen was found compared to that of Cattle (71.50% and 79.0%) and Goat (77.4% and 79.62%) semen. Total 5500 doses of buffalo semen and 2940 doses of goat semen has been conserved. This project will help to establish a guideline for semen cryopreservation of indigenous germplasm of Bangladesh and to conserve potential germplasm for future use.

De novo whole genome sequence of Indigenous chicken (Hilly chicken) of Bangladesh and exploring the unique genome

This project was carried out to develop a whole genome dataset of Hilly chicken with the use of next generation sequencing (NGS) technology as Hilly chickens are reportedly comparably superior to other local chickens according to phenotypic productivity tests. A total of 10 blood samples were collected from Naikkhonchari Hill tract chicken populations. Blood sample was collected from the brachial wing vein following standard procedure. Genomic DNA were extracted from the blood samples (n=10) using commercial DNA extraction kit (AddBio, Korea) and the quality of the extracted genomic DNA were assessed using Qubit 3.0 fluorimeter.

Statistics without reference	SRR26844091	GCA_000002315.5_GRCg6a_genomic
# contigs	32 735	456
# contigs (>= 0 bp)	106 924	462
# contigs (>= 1000 bp)	6855	438
# contigs (>= 5000 bp)	357	196
# contigs (>= 10000 bp)	147	133
# contigs (>= 25000 bp)	62	61
# contigs (>= 50000 bp)	43	49
Largest contig	193 063 023	197 608 386
Total length	1 042 686 836	1 065 345 931
Total length (>= 0 bp)	1 021 866 139	1 065 348 550
Total length (>= 1000 bp)	1 025 641 263	1 065 334 394
Total length (>= 5000 bp)	1 014 940 662	1 065 041 790
Total length (>= 10000 bp)	1 013 437 039	1 064 264 785
Total length (>= 25000 bp)	1 012 219 788	1 061 459 505
Total length (>= 50000 bp)	1 011 599 288	1 060 887 661
N50	92 506 900	91 315 245
N75	24 259 388	24 153 086
L50	4	4
L75	10	10
GC (%)	41.98	42.23
Mismatches		
# N's	6 452 700	9 784 466
# N's per 100 kbp	618.65	918.43

Fig. : Results of assembled data using Quast tool

The good quality genomic DNA (evaluated by Agarose gel electroporesis) from two chickens were sent to Illumina Sequencing platform (NextSeq 2000) for NGS data generation. The NGS raw data were then assembled and annotated using bioinformatics tools. Sequence data quality was assessed using FastQC tool. The high quality reads were assembled using Abyss tool. QUAST tool was used to assess the quality of assembly and Glimmer HMM software was used for annotation. From the analysis of the WGS of Hilly chicken performed on Quast, it was found that the N50, which represents the number of the contigs of the genome was 92506900. The largest contig size was 193063023. The total length of the genome was 1011599288 base pairs. The percentage of guanine and cytosine nucleotides in the genome was 41.98%. The number of N's, or ambiguous bases, per 100 kbp was 618.65. The BUSCO analyses indicated 95% genome completeness. Overall, these findings indicated that the Hilly chicken genome had been successfully assembled with high quality and integrity. The WGS analysis of Hilly chicken was the first study of its kind in Bangladesh which will help to identify important genes related to a particular trait associated with adaptation or prolificacy. The genetic tools and experiences from this current project may offer a new frontier towards conservation of genetic resources.

Production of oxalate free Napier grass through gene editing and tissue culture technique

Sub-title: Determination of Oxalate content in Napier varieties and identification of gene responsible for oxalate content in Napier Grass

Fig. : Napier experimental plot at BLRI

Many farmers prefer Napier grass because of its excellent biomass yield, elevated crude protein concentration, and easy propagation. However, Napier grass contains oxalate, which is an anti-nutritional compound. The ongoing research work has identified the cutting-edge Napier cultivars that consistently preserve the standard oxalate content while achieving high biomass production and nutrient composition. The five Napier cultivars (Napier-3 (hybrid), Napier-4 (Vietnam), Napier-5 (salt-tolerant), Puckchong, and Napier color) have been chosen for the purpose of quantifying the oxalate content at intervals of 10, 20, 30, 40, and 50 days with two replications. The land was then divided into 10 equal plots of 4 x 4 m^2, separated by an alley of about 1.5 m. All agronomical practices, such as fertilizer doses (2:1:1; N: P: K), irrigation, and weeding, were the same. To follow the cutting intervals, the sample was collected for chemical analysis (DM, CP, ADF, and NDF) at the animal nutrition laboratory of BLRI and also determined the oxalate content to follow Martz FA et al., 1990 protocol at the BCSIR lab. After a 30-day period, Napier-3 exhibited a 1.55% oxalate production rate, with CP and ADF levels of 18.5% and 32.0%, respectively. This stage proved to be the most effective in reducing oxalate content (below 2% for ruminant animals) while maximizing nutritional levels. Regarding Napier-5 and Pakchon grass, when 20 days old, they showed encouraging outcomes in terms of elevating CP levels (19.5% and 20.5%, respectively) and reducing ADF (30.5% and 31.0%, respectively) and oxalate content (1.27% and 1.14%, respectively). There was no notable interaction between Napier-4 and Napier color. In conclusion, the Napier cultivars were graded according to their high nutrient and low oxalate levels: Pakchon> Napier-5> Napier-3>Napier color> Napier-4. Raw Napier samples (Pakchong and Napier-5) were sent to the Beijing Genomics Institute (CNGB), Shenzhen, China, to identify oxalate-producing genes in Napier grass.

Conservation and performance evaluation of pure Red Chittagong cattle (RCC) and their graded progeny at the community level

Fig. : Graded RCC hub at Kamalapur village, Rajshahi

A progeny testing program is a prerequisite for continued genetic improvement in a country's cattle population. As Red Chittagong Cattle (RCC) is one of the most promising indigenous cattle in Bangladesh, selecting some candidate bulls from the RCC herd is necessary to produce high-quality frozen semen. Thus, artificial insemination (AI) can be employed to spread the outstanding genetic potential of RCC throughout the country. Under the recently completed ADP project, RCC (Phase-II), 2995 AI were conducted, and 279 pure RCC and 386 graded RCC were produced during the project intervention. Therefore, this study evaluated the performance of progressive generations of pure and graded RCC at the rural community level. To fulfill the objectives, 100 enlisted RCC farmers from Chattogram district (Hashimpur and Chandanaish) and 50 farmers from Rajshahi (Kamalapur, and Godagari) were selected for pure RCC and graded RCC progeny, respectively. Semen was collected from 6 selected candidate bulls, and collected semen was cryopreserved after semen quality evaluation. Then, the frozen semen was used to inseminate the cows at the community level. Three hundred herd books were provided to the farmers to record reproductive information. In Rajshahi, AI procedures were performed on the 50 enlisted cows; 35 calves were born, and 15 were pregnant. However, in Chattogram, 43 pure RCC calves were born, 16 calves were sold out, and 29 cows were pregnant. An independent sample t-test using SPPS (20.00) was used to compare pure RCC and graded RCC mean body weights at different ages. Native cattle had a lower birth weight than pure RCC and Graded RCC (10.8 vs 16.21 vs 13.27). It also showed that graded RCC gained 47.0% more per day than native cattle. This is an ongoing project. This study is expected to contribute to the establishment of a pure RCC hub in Hashimpur, Chattogram, and a Graded RCC hub in Kamalapur, Rajshahi.

Goat Production Research Division

Project title: Identification of major goat health problems and their mitigation in different agro-ecological zones of Bangladesh

Subtitle: Sero-prevalence and molecular detection of Contagious Caprine Pleuropneumonia (CCPP) in goats of Bangladesh

Contagious caprine pleuropneumonia (CCPP) is a highly contagious and serious respiratory disease *affecting goat and wild ruminant's species, caused by Mycoplasma capricolum subsp.* capripneumoniae (MCCP). The disease has a great global concern which is characterized by coughing, severe respiratory distress, high fever and high mortality rates. However, there is no data about the Contagious Caprine pleuropneumonia in this country. So, this study was designed to determine the sero-prevalence of CCPP in the selected goat-prone areas in Bangladesh and molecular identification of the causal agent of CCPP from goat. For achieving these objectives, a total of 402 serum samples were collected from goats in our selected study area and screened for anti-CCPP antibodies using a commercial ELISA kit as per the manufacturer's instructions. Some information's related to CCPP were collected by using a standard questionnaire from the goat owners by direct interview to know the possible risk factors for causing this disease. Besides, a total of 90 suspected lung samples were collected from goats during the period of July 2022 to June 2023 for molecular detection. All the lungs' samples were collected aseptically and transported to the small ruminant's research laboratory, BLRI, where all the goats were vaccinated by PPR vaccine. Subsequently, collected samples were processed and the genomic DNA was isolated using commercial DNA extraction kit. PCR amplification was carried out targeting the 16S rRNA gene using universal primer of *Mycoplsma mycoides* cluster and then confirmed the *Mycoplasma capricolum* subspecies *capripneumoniae* using the specific primer of MCCP and targeted PCR amplicon was 316 bp. We found 7.21% (29/402) goats were seropositive towards CCPP. Sex (Female), age (Adult), flock size (Large) and BCS (Poor) of animals were observed to be important risk factors for CCPP seropositivity in Bangladesh. We confirmed CCPP by molecularly (PCR) which is the first time in Bangladesh. The findings of this study confirmed that occurrence of CCPP in Bangladeshi goats and also determine the sero-prevalence of CCPP in Bangladesh.

Project title: Identification of major goat health problems and their mitigation in different agro-ecological zones of Bangladesh

Subtitle: Molecular detection and phylogenetic analysis of Contagious Ecthyma virus for the prerequisite of vaccine seed development

Contagious Ecthyma (CE) is a highly contagious viral skin disease in goats and sheep caused by the CE virus. CE is characterized by proliferative skin lesions of

the lips, muzzle, ears, and eyelids, around the mouth, udder and nostrils of lambs and kids. All breeds, sex and age groups of goats and sheep are susceptible to this disease, although young animals are highly susceptible and more commonly affected. The present study was undertaken to isolate, identify and characterize CEV from suspected field samples. A total of 49 (16, 09, 06, 11 and 07 respectively from Savar, Rajshahi, Faridpur, Meherpur and Chuadanga) clinically suspected CE field samples (scab materials) were collected and detected by PCR. During collections of samples we considered age, sex and season. DNA was extracted using the DNA extraction kit (Monarch®, USA) according to the manufacturer's instructions. Subsequently, PCR was performed for the detection of the CEV using three sets of primers targeting three different genes (VIR, GIF and vIL) of CEV. The PCR-positive samples were used for partial gene sequencing. In addition, inoculum was prepared from PCR-positive samples (OIE, 2017) and inoculated into primary Lamb testicular Cell (LTC) for the isolation of CEV. At each time, LTC infected with CEV were harvested and confirmed by PCR. Out of 49 CE suspected samples, 34.69% (17/49) were found positive for CEV by PCR. Our study on the GIF and vIL gene sequences provides evidence of the close relationship as well as genetic variation among the CEV strains that are circulating in Bangladesh and worldwide (Picture 1). From our study, it is observed that almost all age groups of goats are susceptible to CE and young animals (> 3 months) are more susceptible than in adults. We also found winter season is more vulnerable than others season. Phylogenetic analysis showed that Bangladeshi isolates of CEV was closely related to each other's and also high homology with the CEV isolates of Indian variant. In primary LTC, positive isolates produced a cytopathic effect (CPE) at 6-7 days of post inoculation (dpi), and CPE was characterized by rounding and detachment of cells.

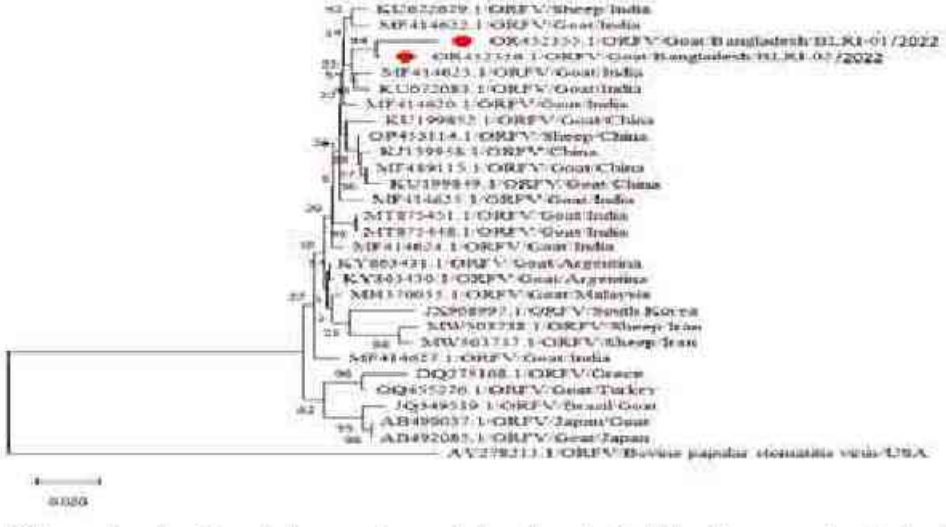

Fig: Picture showing the phylogenetic analysis of goats CEV isolates constructed using neighbor joining methods.

Project Title: Piloting castrated male goat fattening through low-cost grass based TMR under stall-feeding condition

Subtitle: Fattening castrated male goat through cost effective grass based TMR under stall-fed condition

The project was implemented to develop TMR and animal performance evaluation. For achieving the objectives of the study, a factorial design was employed to evaluate the performance of castrated male goats through cost-effective grass-based TMR under stall-feeding conditions. Rajshahi (Komlapur), Dhamarai (Sharifbug), and BLRI were selected AR where different AG groups [3-6, 6-9, and 9-12, months (M)] and continued a feeding trail with 3 (Control, TMR 1: Roughage (R): Concentrate (C) = 60:40 and TMR 2: R:C = 70:30) types of feed for a period of 120 days. The animals were weighed at an interval of 15 days, and their feed intake, FCR, growth performance, and cost-net profit calculation were analyzed statistically using the compared means with SPSS-20.0. The highest ADG was found for 3-6 M (80g/day) AG group animal followed 6-9M (70g/day), and 9-12 M (70g/day), respectively. The FCR was increased with the increase in AG, so the FCR for 3-6 M animal was 3.95 kg, followed by 6-9 M (5.47kg), and 9-12 M (6.93kg). AR has a significant impact on ADG ($p<0.001$), FCR ($p<0.001$) and DMI ($p<0.001$) of goat. The ADG was the same in Dhamrai and BLRI (80g/day), but slightly lower in Rajshahi (60g/day). FCR and DMI were highest in Rajshahi at 7.30 and 0.42, followed by BLRI at 5.45 and 0.40, and Dhamrai at 5.23 and 0.39.Diet or RA have a significant influence on ADG ($p<0.001$) and DMI ($p<0.001$), except for FCR ($p>0.05$). ADG and DMI were highest in goats fed a 60:40 R and C ratio combined effect of AR and AG group, AR and RA, AG and RA & AR, RA and AR have significant effect on ADG ($p<0.001$), FCR ($p<0.001$), and DMI ($p<0.001$) of goats, however, there is no significant effect ($p>0.05$) on benefit-cost ratio (BCR) in comparison with the combination of AG and RA, which significantly differ at 0.5 level of confidence. The results obtained so far indicate that goats with an AG of 3-6 M have a faster growth rate, while goats with an AG of 6–9 M have a higher FCR. Using a diet consisting of 70% R and 30% C for fattening castrated male goats under stall feeding conditions is beneficial in terms of FCR, DMI, and BCR.

Fig: **FGD with Farmer**

Fig: **Preparation of TMR**

Fig: **Feeding of TMR**

Sheep Production Research Division

Evaluation of exotic pure and their crossbred's sheep in Bangladesh

Most of the sheep in Bangladesh are native non-descript types but no established sheep breed in the country. Moreover, the growth rate of native sheep is low, so crossbreeding could be an effective tool to increase their growth rate and productivity. However, very limited research work has done on crossbred sheep development in Bangladesh. Thus, the present study was undertaken to evaluate the productive and reproductive performance of different crossbreds and to evaluate the adaptability of different crossbreds in hot and humid climatic conditions. The breeding program was conducted at Sheep Research farm, BLRI, Savar, Dhaka. The crossbreeding program was conducted with native sheep (Coastal and Jamuna River Basin) as dam and Dorper, Perendale, Suffolk and Damara sheep as sire. The breeding program was designed in such a way that resists inbreeding and maintain 50% foreign blood. Then, *Inter-se* mating within all the crossbreds was practiced. The selection targets for crossbreds were minimum birth weight 3 kg, 6 months body weight 20 kg and 12 months body weight 30 kg. Subsequent data on productive and reproductive performance were recorded regularly. The recorded data were analyzed by General Linear Model (GLM) procedure of Statistical Package for the Social Sciences (SPSS) version 20.0. To see the significant differences among the mean values, Duncan's multiple range test (DMRT) was performed.The average litter size, birth weight (kg), weaning weight (kg), 6-month and 12-month body weight (kg) of Dorper, Perendale, Suffolk & Damara crossbred sheep were 1.44±0.07, 2.04±0.05, 11.53±0.47, 15.67±0.69 & 21.58±0.95; 1.14±0.10, 2.09±0.07, 11.65±0.57, 14.68±0.71 & 20.35±1.03; 1.12±0.13, 2.06±0.09, 11.90±0.70, 15.04±0.89 & 21.80±0.99 and 1.67±0.09, 2.02±0.06, 11.41±0.63, 14.74±0.85 & 20.11±1.22, respectively. In case of average litter size, Damara and Dorper crossbred performed significantly better (p=0-0.001) followed by Perendale and Suffolk crossbred, respectively. Among the crossbreds, growth performance was found non-significant (p>0.05). In conclusion, superior rams and ewes will be selected by the individual performance generation after generation to attain the selection goal. These findings give us more attention for continuing further research program to produce crossbreds sheep in our country.

Fig: Dorper Crossbred

Fig: Perendale Crossbred

Fig: Suffolk crossbred

Fig: Damara Crossbred

Project Title: Ex-situ conservation and Improvement of native sheep at Bangladesh Livestock Research Institute

Sheep is a potential livestock species having some unique attributes such as high adaptability in harsh environments with low level of input, highly resistance to diseases and multiple births in each lambing. These advantages need to be properly exploited to enhance the contribution of sheep in the national economy of Bangladesh. Continuous improvement by genetic selection, proper feeding and other management system may contribute to improve sheep genetic resources. The project has been designed to develop superior native sheep germplasm and to continue their improvement at BLRI and also to study the productive and reproductive performances of native sheep. The breeding program was conducted at Sheep Research Farm, BLRI with four different types of sheep viz. Coastal, Jamuna River basin, Barind and Garole. The management system was semi-intensive where green grass (ad-libitum) and concentrate were supplied twice daily at the rate of 1.5% of the body weight of animal per day. Open Nucleus Breeding System was adopted in order to improve the genetic and phenotypic traits of existing breeding sheep stock avoiding inbreeding. The targeted litter size, birth weight and 6 months body weight were minimum 2 lambs per lambing, 1.5 kg and 14 kg. The subsequent data were recorded throughout the year. The average litter size, birth weight, 3 months and 6 months body weight of Coastal sheep were 1.42±0.05, 1.59±0.02 kg, 7.09±0.19 kg and 11.82±0.37 kg, respectively; in case of Jamuna River basin sheep, the values were 1.56±0.08, 1.25±0.03 kg, 6.87±0.29 kg and 10.98±0.47 kg, respectively; the values for Barind sheep were 1.63±0.07, 1.29±0.02 kg, 6.90±0.22 kg, 11.29±0.34 kg, respectively and in case of Garole sheep, the values were 1.41±0.07, 1.24±0.03 kg, 6.32±0.19 kg, 9.81±0.34 kg, respectively. There were no significant differences in terms of 3 months body weight (kg) but in case of litter size and 6 months body weight significant differences ($p<0.05$) found among the genotypes. Furthermore, in case of birth weight there were highly significant differences ($p<0.001$) among four types of sheep. Highest birth weight and 6 months body weight were found in Coastal sheep while the highest litter size was found in Barind sheep.The findings suggest further research until a significant level of improvement of the native sheep is achieved at BLRI.

Fig: Coastal Sheep

Fig: JRB Sheep

Fig: Barind Sheep

Fig: Garole Sheep

Project Title: Investigation of Pneumonic Pasteurellosis in sheep and their mitigation to develop a model sheep health management package for ideal farming

Pneumonic pasteurellosis is an important bacterial disease in sheep caused by *Mannheimia haemolytica* and *Pasteurella multocida* (PTM). This disease can cause serious health deterioration increasing treatment cost where antimicrobial usage becomes obligatory. Prevention of this disease can be done by effective vaccination. In Bangladesh, Govt. produced Hemorrhagic Septicemia (HS) vaccine is used in small ruminants but the vaccine effectiveness study has not been done yet. Hence a vaccine effectiveness study was designed with twenty HS seronegative growing apparently healthy female sheep (equally divided to treatment and control group) aged 3 to 4 months for on station experiment. Following deworming and acclimatization, blood was collected at 7, 14, 21, 28, 35, 42, 49, 56, and 63 days post vaccination (oil adjuvant vaccine S/C @ 1 ml/sheep). The serum was preserved at -20°C and PTM Indirect Antibody ELISA was performed according to the manufacturer's instructions (Sunlong Biotech, China). A Two-Sample t-test was performed using Microsoft Excell Data Analysis Toolkit (Microsoft Office LTSC 2021). It was found that the mean ±SD of unvaccinated and vaccinated group's OD were 0.05965±0.0025 and 0.07269±0.0092 respectively. Both the mean differed significantly (P<0.001) in each case of the variance assuming equal and unequal. A natural logarithmic equation of Y=0.0116LN(X)+0.0552 (Fig.ure 1) gives a good prediction with OR=0.7693 (Fig.ure 1). But due to the complexity of the vaccine distribution pattern, a polynomial equation with more robust dataset based on field trial with multiple categorical parameters and protective antibody titer would serve better in deduction. This study reveals that LRI produced HS vaccine generates significantly increased level of antibody titer from day 14 that increased logarithmically up to 42 days and starts to decline by 49 days and maintains static course from 56 to 63 days (Fig.).

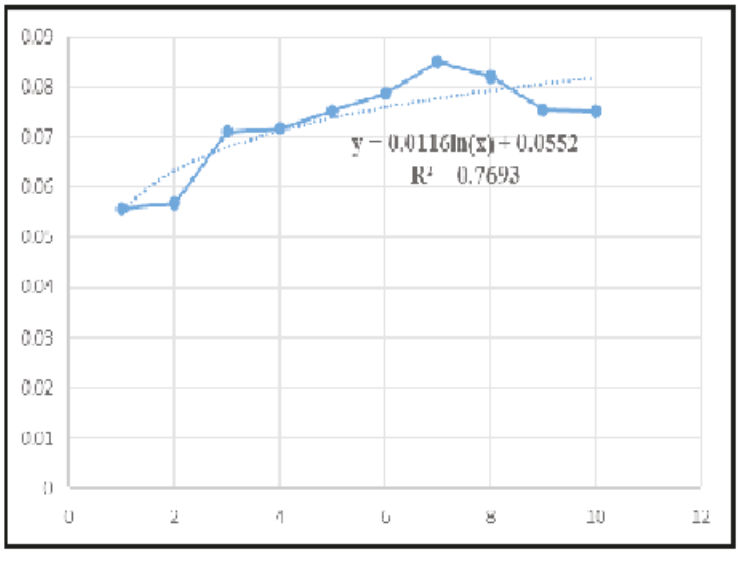

Fig.: Scatter Plot of Vaccinated Group Sera OD Value (Logarithmic Equation)

Poultry Production Research Division

Development of climate resilient egg and meat type breed/strain using native germplasm

Component B: Improvement of egg and meat producing duck through selection and breeding: Production performance G_8 and field trial of BLRI improved native duck

The purpose of this study was to investigate the performance of the 8th generation of BLRI-1 (Rupali) and BLRI-2 (Nageswari) ducks. The egg production data of 8th generation ducks were recorded. Additionally, Rupali and Nageswari ducks are being validated. 10 farmers from Sathkhira areas were selected and received Rupali, Nageswari, local, and Jending ducks. Performance data were collected. To minimize production costs, pekin duck rations were supplemented with azolla. Sixty-day old pekin ducks were divided into four groups and were randomly fed four experimental diets for a period of 70 days. Data was analyzed by SPSS version 20 and differences were determined using DMRT. Egg mass was significantly higher in Rupali duck (41.42g) than Nageswari duck (39.43g) per day. The Nagesswari ducks (137.60 g/d) consumed significantly less feed than the Rupali ducks (140.34 g/d). Rupali (3.45) ducks had significantly better FCR than Nageswari (3.82). Rupali duck eggs had an optimum weight. In contrast, other egg quality parameters did not show a significant difference. Among the genotypes, there is a substantial difference in age at sexual maturity (d) in Jending ducks. The Rupali duck had a higher body weight. In 161 days of egg production in farmer's field, Rupali, Nageswari, local and Jending ducks produced 68.06, 63.11, 55.03 and 78.23 eggs, respectively. Compared with control groups, Pekin ducks fed fresh azolla @200g/duck/day significantly decreased feed consumption, but FCR was significantly better in T_2 group. There were also significant improvements in final body weight and daily weight gain in the T_2 group. There was a significant amount of breast meat found in T_2 group, while wing meat was better in T_3. However, lower fat is observed in the T_2 and T_3 groups. The egg production rates of Rupali and Nageswari ducks were almost similar. Thus, both ducks have been conserved for improvement. It is planned to continue the side-by-side validation program. With fresh azolla consumed at 150 grams/duck/day, better performance was achieved.

Development of climate resilient egg and meat type breed/strain using native germplasm

Component A: Conservation and Improvement of Indigenous chickens as worthy genetic resources of Bangladesh and development of the heat tolerant high yielding breed/strain

The present 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, to select parental birds and breed them in an assortative plan for the production of eleventh generation birds, to collect, evaluate and dilute of native chicken cock semen. A total of 4118-day-old chicks comprising of 3 types of chicken namely Naked Neck (NN-1318), Hilly (HI-1240) and Non-descript Deshi (ND-1560) were hatched to produce eleventh generation (G_{11}). Improvement target of egg production (EP) rate is to increase by 2% per generation, Improvement target of egg weight (EW) is to increase by 1 g, and improvement target of growth rate is to increase by 20 g per generation. In eleventh generation (G_{11}), selection was practiced at 40th week of age on the basis of selection Index to produce next generation. Semen was collected manually from male by abdominal massage technique at 28, 32 and 36 week of age. Annual egg production (no) was significantly ($p<0.001$) higher in NN (193.5), Intermediate in ND (187.4) and lowest in HI (165.5). The fertility and the hatchability on fertile eggs percentage was significantly ($p<0.001$) higher in NN (84.80) and in HI (83.19%); respectively. Age at sexual maturity (ASM) was 10.8 days earlier in NN (155.8 days) than HI (166.6 days) which was significantly ($p<0.001$) affected by genotype. Egg production (no.) of ND, HI and NN birds was expected to increase by 0.83, 2.24 and 1.41%, respectively. Higher semen volume was observed in NN at all stages of age. In all genotypes semen volume was increased with the increased of body weight. The rate of inbreeding (ΔF) calculated for the native chicken was 0.005 (0.5%) which is found very negligible. It is concluded that different genotypes have significant effect on egg production, fertility, hatchability, age at sexual maturity and semen volume.

Fig: Farm & Laboratory activities

On-farm measurement of noxious greenhouse gases from poultry litter and their possible utilization

The present experiment was undertaken to know the effects of low protein diets with glutamine supplementation on the performance, blood properties, gas emission of laying hens. At 36 weeks of age, a total of 120 laying hens were randomly assigned to a 3×2 factorial arrangement of treatments (4 treatment, 5 replication) consisting of three levels of glutamine (0, 0.15, and 0.25 %) and two levels of crude protein (17, 15%) in the diet. The present results showed that no significant differences were found among the treatments. But a numerically higher egg production percentage was found in T_1 (17% CP x 0% Glu) and T_6 (15% CP x 0.25% Glu) treatments than that of other treatments. Feed intake was higher in the T_3 treatment and lower in the T_4 treatment, but FCR was better in the T_1 and T_6 treatments. In egg quality parameters, albumen height was higher in the T_3 and T_6 treatments, and yolk weight was higher in the T_5 treatment. On the other hand, there was no dietary interaction between CP and glutamin on the albumin index, yolk index, or Haugh unit, respectively. In blood properties, triglycerides and total cholesterol levels were significantly higher in T_1 and T_2 treatments than in T_5 and T_6 treatments. In contrast, glucose, uric acid, Ca, and P levels in the blood were not influenced by the interaction of CP and glutamin in the diet. In poultry litter, a significantly lower level of NH_3, H_2S, and CH_4S was found in T_6 treatments as compared to T_1 treatments, but CO_2% was higher in T_2 and T_3 treatments. But variations in CP and glutamin in the diet did not affect the CH_4, O_2, and SO_2 contents of the litter. In conclusion, a 2% reduction in protein with a supplement of 0.25% glutamine in the diet of BLRI layer chicken 2 (Shoma) had numerically increased the production performances and reduced gas emissions (NH_3, H_2S, and CH_4S) from poultry litter.

Study on feeding management guideline & nutrient requirement of BLRI improved native chicken and mitigation of greenhouse gas from poultry litter

Component A: Performance, carcass characteristics and meat chemical composition of BLRI improved non-descript desi (ND) and naked neck (NN) chickens fed graded levels of dietary energy and protein concentration

Native or local chickens provide a valuable source of animal protein, both in the form of meat and eggs. In most developing countries, including Bangladesh, animal and poultry production must be improved to meet ongoing animal protein demands. A 3x3 factorial arrangement with three metabolizable energy (ME) levels (2800, 3000, 3200 kcal/kg) and three crude protein (CP) levels (18.0, 20.0 and 22.0%), respectively, was

employed to investigate the influence of varying levels of dietary energy and protein on BLRI improved non-descriptive deshi chickens' performance and carcass quality. There were 351-day old native chicks randomly divided into 9 treatments, each with three replicates. The diets were in meal form, and water and feed were available *ad libitum*. All performance parameters including body weight, body weight gain, feed intake, feed conversion ratio was monitored and recorded, carcass characteristics and meat quality were measured. Chickens receiving diets with higher levels of ME (3200kcal/kg) and CP (22%) gained more body weight, daily gain and better FCR than those who received lower dietary ME and CP diets during the experimental period. However, no significant interaction between dietary ME and CP concentrations with regard to body weight, FCR and feed intake except for daily gain. Varying protein and energy levels did not affect (P>0.05) carcass, breast and thigh muscle, wing, legs, and liver percentage of the non-descriptive deshi chicken. Both ME and CP levels did not differ (P > 0.05) in pH value, drip loss percentage, and meat color grades. The different energy and crude protein level had significant effect on final body weight, body weight gain and FCR of non-descriptive deshi chicken. It can be thus recommended that higher level of energy (3200 kcal/kg) and higher protein (22%) combination diet could be feed to improve the performance of non-descriptive deshi chicken.

Conservation and Improvement of Exotic germ plasms and validation the performance of BLRI layer chicken 1 (Shuvra) and BLRI layer chicken 2 (Shorna)

BLRI are being maintained four pure breeds of chicken at Poultry Research Farm with the objectives of to conserve and strengthen production of four pure lines of chicken and to estimate genetic gain of 4 pure line chickens under intensive management condition and to evaluate the cross-breed, of locally adopted exotic germplasms. A total of 8000 pedigree hatched day old chicks (2000 for each line) were hatched as 20th generation and they were identified individually by wing band. Males and females were selected at the age of 8 and 16 weeks on the basis of pedigree records and phenotypic characteristics. Finally, 50 males and 200 females were selected at 40 weeks of age on the basis of selection index to produce next generation. Four selection criteria were observed in 4 different pure line chickens where after selection, selection differential (s) was expected to increase 3.9,1.08,1.73 and 1.51 in egg weight (g) and 12.53,7.60,18.76 and 15.92 in egg production (%) in WHL, RIR, WR and BPR genotypes respectively. After selection in WHL, RIR, WR and BPR chicken genotypes, selection intensity(i) was 2.09,0,61,1.04 ,0.81 and selection response was 1.88, 1.14, 2.81 and 2.39 respectively. On the other hand, performance of different meat type cross bred chickens (involving native & exotic genotype) also measured.

The average body weight of 12 weeks of age, weight gain, feed intake and FCR were found 1302.5, 1215.1, 1352.8g; 1265.19, 1179.23, 1314.74g; 3431.21, 3115.65, 3447.25g and 2.712, 2.642 & 2.622 in cross1, cross2 and cross 3 respectively. Therefore, body weight and weight gain were significantly ($P<0.05$) higher in cross 3 chicken than others. The carcass weight, dressing percentage and abdominal fat weight were found 687.6, 644, 709.1; 52.59, 53.04, 52.36 and 5.1, 7.7 and 4.2 in cross 1, 2 & 3 respectively. Finally based on results, pure lines are conserve avoiding inbreeding and cross 3 performance is better than others. Further follow up experiment is needed to know the performance under different farming condition.

Development of climate resilient egg and meat type breed/strain using native germplasm

Component C: Development of meat type quail through appropriate breeding

The present study was conducted at Bangladesh Livestock Research Institute, Savar, Dhaka with the objectives, (i) to increase the sixth week body weight of Dhakai and BB-white quail through selective breeding (ii) to select parental birds (males and females) and breed them using best to best mating plan for the production of 13th generation birds. A total of 1184-day-old chicks comprising of 4 types of quail namely Black (Bl-344), Brown (Br-265), Dhakai (D-309) and White (W-266) were hatched. Ten (10) birds from each genotype of quail were slaughtered to evaluate carcass characteristics and determine the nutrient content of meat in twelfth generation (G_{12}) at fifth week of age. Higher day old chick weight, was found in Bl (7.1±0.06g) compared to other genotypes. The 5th week BW and growth rate was significantly ($p<0.001$) higher in D (140.2±1.4g and 3.8±0.04) than other three genotypes. Feed conversion ratio (FCR) from 0 to 5 weeks of age was significantly better in D (3.3). The mortality percentage (0-4 weeks) was significantly ($p<0.001$) higher in W (3.4%) followed by Bl (1.2%), Br (1.1%), and D (0.3%). Dressing percentage was significantly ($p<0.001$) higher in D (75.18%) followed by W (71.92%), Bl (69.85%), and Br (67.85%) genotypes. The highest crude protein content of quail meat was found in Br (24.8%)compared to D (23.7%), W (23.4%) and Bl (22.5%) genotype. The 6th week BW ofmale quails of Bl, Br, D and W were expected to increase by 4.20, 1.79, 4.18 and 2.88g; respectively. While in female quails of Bl, Br, D and W; the expected responses were 3.37, 3.11, 6.28 and 3.36g; respectively. It is concluded that Dhakai quail is superior based on body weight and dressing percentage on the other hand white quail for egg production and crude protein content

Socio-economic Research Division

Socioeconomic analysis of antibiotic use in poultry production in Bangladesh

A huge number of poultry farms are established across the country to respond to the increased demand for animal nutrition. To boost production and supply, farmers use antibiotics to treat, prevent, and control poultry diseases immensely. This overuse of antibiotics can stimulate antimicrobial resistance that can be a big threat to human health. Considering the facts, the study aims to identify the present scenario of antibiotic use in poultry production, the cost incurred, and the determination of factors that influence antibiotic use. For this, a total of 243 poultry farms were surveyed covering eight (8) divisions of the country. Moreover, we conducted 30 Key Informant Interviews (KII) in the respective areas. A simple random sampling technique was followed for collecting primary data. We simply applied tabular and multivariate regression analysis. We found 55% broiler farms followed by 24% sonali and 21% layer farms in the areas. We got the highest farm size of 66% small, 82% medium, and 67% medium, respectively for broilers, layers, and sonali. For native chickens, we found 16.89 birds per farm. In the case of antibiotic use, broiler farmers (37%) hold the top rank followed by sonali (27%) and layer farmers (26%). On the other hand, native chicken rearers (10%) were almost free from antibiotic use. Moreover, we calculated antibiotic cost per batch (1000 birds) was BDT 2,580, BDT 2,560, and BDT 23,300 for broiler, sonali, and layer, respectively. The antibiotic cost was half for broiler and one-third for sonali and layer in comparison with the total treatment cost (doctors' consultation fees, medicine costs, and vaccine costs). We also found that farmers who had taken advice from the Upazila Veterinary Hospital used fewer antibiotics. In conclusion, we can say almost 95% of poultry farmers belong to the small and medium categories. Antibiotic consumption was the highest in broiler production. Therefore, training on antibiotic use may help regulating the unscrupulous use of antibiotics.

Fig. Broiler Farm

Fig. Local drug seller

Assessing livestock rearing knowledge, attitude and practice in the coastal belt of Bangladesh

Livestock production and the returns from it vary over regions due to the availability of modern technological facilities and agro-climatic factors. Nowadays the coastal zones of Bangladesh are facing various challenges regarding livestock production and management. Cyclones, saline water intrusion, and sea level rise are major environmental issues that threaten livestock production adversely. Considering the above facts, the present study took the objectives to identify the present livestock management scenario; and analyze knowledge, attitudes, and practices for livestock rearing. As study areas, we covered 8 Upazilas from 4 districts of the Barishal division. We randomly collected data from 35 households from each Upazila and the total sample size was 280. We used descriptive statistics. From the analysis, we found that farmers were less educated (49% had primary level only) and aged enough. They usually reared less productive livestock species as they were mostly local breeds (73%) followed by crossbreds (17%). About 71% of farm households reared goats and they had approximately 4 goats/household. This indicates that there is a scope to promote goat production in the areas. Here, there is a huge shortage of straw and green grasses due to limited agricultural practices and salinity. Farmers managed 76% of straw from their own sources and the rest was acquired by purchasing. On the other hand, 100% of farmers were dependent on pasture land for green grasses. In the case of housing, we found 62% were tin sheds followed by 23% mud-house and 16% semi-paka meaning that housing management for their livestock was very poor. Though the farmers had a good score on attitude (>70%) regarding livestock management and practices, they had enough knowledge and practice gap (<50%). Therefore, our recommendations are hands-on training is very crucial regarding up-to-date livestock technologies and innovations and the introduction of improved livestock species and saline-tolerant high-yielding fodder varieties for the coastal regions.

Fig. Housing system

Fig. Poor health of cattle

Marketing of beef in selected areas of Bangladesh

Beef is one of the most popular dietary items for Bangladeshi consumers. For this, a good number of people are doing meat-selling business as a main profession. But, the price of beef is now going beyond the purchasing power of the general consumers. As a result, the profit margin and the cost associated with meat selling remain under pressure. On the other hand, meat selling in open meat shops has some negative aspects. Taking this view as a research problem, the study encompassed the objectives of identifying the profitability of meat selling by meat sellers and exploring marketing channels for meat selling. In addition, this study seeks consumers' opinions regarding the safety issues of meat selling in open meat shops. For this, we collected primary data across the country and the total sample size was 420 (180 meat sellers and 240 consumers). A simple random sampling technique was followed. Profitability analysis was done by adopting descriptive statistics. From the results, it was evident that meat sellers bore a total cost of BDT 70,031 per quintal (100 kg) whereas they earned BDT 2,551 as a net return. The benefit-cost ratio (BCR) was estimated at 1.04 which means beef marketing is a profitable business. The highest percentage (36%) of beef cattle channeled through farmer to consumer followed by farmer-meat seller-consumer (24%). It was also assessed that 67.92% of consumers were not satisfied with quality issues of open beef selling due to mosquitoes sitting and leaving larvae, dust falling, bacteria growing at the end of the day, loss of taste, discoloration, mixing state meat etc. From the meat sellers' point of view, the main problem of open meat selling was the lack of hygienic places for slaughtering (38%). Therefore, we recommend minimizing marketing tools and taxes and increasing leather prices. In addition, the government should establish a modern slaughterhouse in each Upazila to facilitate meat selling.

Fig. Beef marketing in Upazila center

Farming System Research Division

Establishment of "BLRI Technology village" at BLRI regional stations

The objective of the study is to disseminate BLRI developed livestock technologies for increasing productivity and to identify the region based problems. A baseline survey was carried out through face-to-face interview of total 885 households. A total of 150 committed farmers from five technology villages were chosen and trained up on need based technologies. We distributed total 400 pure hilly chickens with 12 native sheep, 180 pure naked neck chickens, 200 ducks in Naikhongchhari, Rajshahi and Faridpur technology village respectively. In the Community Approach Diseases Control Model, a total of 4013 cattle, 2741 goats and sheep were dewormed. Under the same model a total of 21542 animals and poultry (6031 chicken and 1416, Ducks) were vaccinated. Sero-monitoring of PPR was done and the results revealed that before vaccination 34.78% and after 21 days of post-vaccination, 84.77% goats were found seropositive. Cost effective pellet feed technology for goats was validated and their daily weight gain was 73.42±31.84gm and 52.52±46.75gm in the treatment group (N=5) and control group (N=5) respectively. Hilly chicken rearing model was validated and we found average age at first laying, egg production (per clutch) and egg weight were 184 days, 18.33±1.75 nos and 42.71±1.02gm at Naikhongchhari. The same parameters also recorded for Rupali duck and those were 180 days 26.00±0.42 nos and 65.14±0.23gm and in Nageshwari 174 days, 32.00±0.16 nos and 57.24±0.38gm respectively. Those parameters in naked neck chickens were 145 days, 20.77±1.55 nos and 43.85±1.22gm in Rajshahi. In Jashore a feeding trial (40% concentrate and 60% roughage providing adlibitum) conducted and the average daily weight gain was 22.66±1.34gm in growing geese. In Baghabari TMR based technology were validated for 60 days on growing beef cattle and the average daily weight gain was found 519.44±10.90gm in fodder based TMR (n=06) and 497.2217±19.44gm in straw based TMR (n=06) and 388.89±14.69gm in the control group. It may be concluded that the validated technologies have created a positive impact among technology village farmers which was encourage other farmers to adopt those technologies.

Fig.: Research activities and LSP development under supervision of BLRI Technology village

Reinforcement of regional livestock research at naikhongchhari

The research was undertaken to conserve improve and promote different livestock, poultry and fodder germplasm and to develop a tick control package for livestock in hilly region. A total of 46 does and 5 bucks were selected from the Hilly Brown Bengal goat and their average litter size was 1.8±0.01, average birth weight, average daily gain up to 3 months for male and female kids were 1.36±0.06kg, 1.30±0.03kg, 41.41±5.95gm and 40.18±3.97gm respectively. We also selected 40 male and 120 female hilly chickens at 40 weeks of age. About 200 hatching eggs were collected from which 136 day-old-chicks (DOC) and finally selected growing 46 females and 44 males. The average egg weight was 44.91±3.1gm, fertility and hatchability rate were 82%, 68.5% where average DOC weight, average male and female BW at 60 days were 30.85±2.46gm, 539.5±83.5gm and 494.0±76.3g. BLRI Napier-3, Napier Pakchong and Red Napier were cultivated at the hill slopes and the average fresh biomass yield of those variety were found as 34.84t/ha, 30.84t/ha and 27.49t/ha respectively. The DM (%) and CP (%) content of BLRI Napier-3 were significantly higher than the other Napier cultivars. A total 590 samples were selected for tick control the study. Ivermectin @0.2mg/kg body weight s/c once time was given on day 01 and 07, dipping with 0.5% malathion was practiced and on day- 14, repeat Ivermectin@0.2mg/kg body weight s/c was given once time. From day 110-170, repeatedly checked the animal body by physically. The highest tick free duration was observed in sheep for second time treatment protocol. Minimum three times administration with Ivermectin and malathion is needed to control ticks over the year which is cost effective for the livestock farm than the usual practice of dipping at 1-month interval. A feeding experiment was conducted for 75 days on 3 different groups (UMS, UTS and Control) of sheep. The highest average daily gain 182.21gm was found in UTS among three groups. Through the suitable utilization of these promising hilly germplasm there is a possible scope to develop and adaptation of region specific technology.

Fig.: Brown Bengal Goat, Tick control and Fodder Bank at Naikhonhchari regional station

Identification of research gap of native chicken in some selected areas of Bangladesh

The present research was carried out for the identification of research gap of native chicken in selected areas of Banglaesh. A structured questionnaire and key informant interviews (KIIs) format was developed for data collection. Native chicken rearing farmers are engaged in agriculture (34.6%) as well as daily labor (21.5%) while most of the farmers are 32.7 % literate and own minimal land. The native chicken farm were categorized into three groups among them 36.9% small (<10), 31.9% medium (10-15) and 31.2% large (>15) sized farm was observed. About 95% farmers involved in rearing common deshi chicken and others (2.3% hilly, 1.2% naked neck and 1.5% naked neck). Farmers only supplied average 34.16±0.25g, 59.01±0.25g, 71.55±0.40g feed to chick, grower and layer respectively. The mature body weight of male and female, average egg production/year, age of first laying (days), laying/clutches time (days), number of broodiness/year, egg laying interval after natural incubation with brooding and chick hatching by natural system were 1.45±0.29, 1.15±0.02, 106.15±1.11, 177.98±0.41, 16.83± 0.28, 4.56± 0.25, 64.70±1.56 and 97.7 days respectively. Native chicken rearing become challenging for farmers due to regular outbreak of diseases like Newcastle 76.2%, Fowl cholera 55.8%, Gumboro 13.5%, fowl pox 19.6%, brooder pneumonia 24.2%, Infectious bronchitis 5%, and other diseases 23.5. The average egg consumption/week was 4.59±0.17 and chicken consumption/month was 1.15±0.03 was recorded. The average gross income, total expense and net benefit 15324.03, 5802.95 and 9521.08 taka respectively furthermore benefit cost ratio 2.64 of native chicken farm in study area. From survey data, farmers faced the challenge of disease outbreak, attacking predators, lack of vaccine, chick mortality, feed price was 86.5%, 82.4%, 66.5%, 60.0%, 48.8% in previous project area whereas 68.8%, 74.4%, 50.0%, 34.44%, 26.6% in newly proposed area of native chicken project. To solve all the gaps and challenges, farmers were recommended some suggestions (training program, govt. vaccine supply should be available, good quality chicks) for native chicken farming. Considering the above findings, it can be concluded that the Native chicken farming is a promising business. A development project is needed to improve the productive and reproductive performance, minimizing disease outbreak.

Fig.: Data collection from natine chicken farmers market and KIIs from ULO

Training, Planning and Technology Testing Division

Impact of training given to farmers on BLRI technologies

This research investigates the impact of haining given to livestock farmers facilitated by the Bangladesh Livestock Livestock Research Institute (BLRI) for transferring technology, adoption of BLRI developed technologies and its impact on the livelihoods of trained farmers from July 2022 to J*,e 2023.4 total of 150 livestock farmers were randomly selected from Naikhongchhari, Jessore sadar, vanga, Baghabari and Godagari Upazilas of Bandarban, Jessore, Sirajgonj, Faridpur and Rajshahi districts respectively and all of the farmers were imparted three days specialized training on BLRI developed technologies. Data were collected through pre-tested questionnaire and analyzed,by the STATA computer software program. The majority of the farmers were male (53.33%) and the average age, family ."-b".., year of schooling and land holding were 37.63+1.42, 4.92+0.09, 6.408+0.74 years and 93.45+17.Bo respectively. The average number of cattle was highest in Godagari (4.13+0.36), goat and sheep was highest in Naikhongchrrari (2'97+0'54) and average poultry holding was highest in Vanga (46.46+2G.41) upazila. This study revealed that the average rice and egg consumption/year/family was highest in Vanga upazilawhich was 6g4. g7 kg and 836 no. respectively. Fish and milk consumption/yearlfamily was highest in Baghab ari upazilawhich was 189'19 kg and 2}4.3gLrespectively. Dal, meat and vegetable consumption/year/family was highest in Naikhongchhari upazila which was 44.11 kg, 113.36 kg and,279.89 kg respectively. Technology adoption by the farmers was highest in Naikhongchhari (56.67%) and lowest in Godagari (100%). Almost all of the farmers of Baghabari and Godagari Upazila performed vaccination (lOO%) and deworming (100%) regularly. The average production and treatment cost were highest in Baghabari, Shahjadpur, upazila (1411g5 Tk and 4561 Tk respectively). The annual income of livestock farmers was highest in Jessore sadar (319440 Tk) and lowest in Godagari (lgg752Tk).

Black Bengal Goat Conservation and Development Research Project

Conservation and improvement of black bengal goat in selected locations in Bangladesh

Goat is now considered as the most promising livestock species for commercial meat production in the country. Among the goat population, more than 90 percent comprise of Black Bengal goats but the purity of this valuable breed is becoming extinct by the time being. Conservation and improvement of Black Bengal goat through community breeding can be one of the tools to overcome the problem as well as meet up the increasing demand of meat production. The aim of this study was to improve the performances of Black Bengal Goat (BBG) at farmer's level, through establishing a community-based Buck park and improving the data recording system for breeding purpose. The study was conducted at 8 different areas viz. Naikhongchari, Godagari, Vanga, Kustia, Meherpur, Chuadanga, Valuka and Muktagacha. Effect of community among all the considering traits was found significant (p0.05) of irrespective age. The highest litter size was found in Chuadanga community followed by Kustia, Godagari, Meherpur, Jossor, Muktagacha, Naikhongchari & Valuka respectively. In case of body weight at different stages, the highest value was found in Meherpur community except the average daily weight gain at 6-9 month of age and the highest value for the trait was found in Chuadanga. The highest kid mortality was found in Chuadanga (4.67%) and lowest mortality was in Kustia community (3.39%). The kid mortality was lower due to different interventions through project activities. It can be concluded that, among all the community, better performance of Black Bengal goat was found at Meherpur. Superior goat will be selected from every community to improve the performance of goat. Therefore, the research program should continue for the coming years to conserve and improve the Black Bengal goat at community level.

Fig: Different regions black bengal goat

Conservation and improvement of black bengal goat and its color variants at Bangladesh livestock research institute

Black Bengal goats and reputed for their, high prolificacy, high fertility, early sexual maturity, adaptability to hot humid conditions and superior quality meat and skin. But, the breed is being diluted by unwanted crossing all over the country resulting genetic erosion of this valuable goat breed. The objectives were- i) to conserve and improve Black Bengal goat through selective breeding; ii) to evaluate the performance of different coat color variants of Black Bengal goat (Solid Black, White Bengal, Dutch belt and Toggenburg) and to produce frozen semen and Artificial Insemination (AI) in Black Bengal goats on-station. The study was conducted in Goat and Sheep Research Farm of BLRI, Savar, Dhaka through Open Nucleus Breeding System (ONBS) avoiding inbreeding. The selection objectives of the study were to improve the prolificacy, milk production and growth rate of the breed. The targeted prolificacy, milk production and 6 months body weight of Black Bengal goat were, minimum 2 kids per kidding; 0.5 litter/day and 12 kg, respectively. Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 20.0. The average litter size, dam milk production and 6 months weight of Solid black genotype were 2.22±0.05, 0.42±0.009 L/d and 10.12.10±0.18 kg, respectively; in case of White Bengal genotype, the values were 2.21±0.05, 0.52±0.02 L/d and 11.58±0.14 kg; in case of Dutch belt genotype the values were 2.11±0.07, 0.45±0.02 L/d and 12.34±0.22 kg, respectively and for Toggenburg genotype, the values were, 2.19±0.07, 0.43±0.02 L/d and 10.46±0.12 kg, respectively. The highest milk production was found in White Bengal genotype while the highest litter size and 6 months body weight was found in Dutch belt genotype. In case of artificial insemination, among the different doses, better result in conception rate was found at 30 and 36 hours after showing heat rather than 24 and 48 hours after showing heat. Highest conception rate was found at 30 hours after showing heat (83.33%) in both BLRI goat research farm and BLRI RS, Rajshahi goat research farm. But, in case of community level at Rajshahi, the highest conception rate was found at 36 hours after showing heat (80%).

Fig: Color variants black bengal goat

Analysis of candidate genes for prolificacy trait in black bengal goat of Bangladesh

Black Bengal goat (BBG) is an important livestock genetic resource after cattle in Bangladesh that has worldwide reputation for their early sexual maturity, higher fertility rate, adaptability, superior meat and skin quality. Candidate gene-based approach has been widely used to select better performed animals with known genetic make-up even at earlier age and thereby, precise selection of animals would be possible within shortest possible time. The objective of the present study were- i) to quantify and evaluate data on prolificacy trait of BBG goat ii) to detect genetic polymorphisms (SNPs) in selected candidate genes related to prolificacy trait in goat and iii) to investigate association between identified SNPs and prolificacy trait in order to develop molecular marker(s) with commercial impacts in BBG of Bangladesh. To comply with the objectives, a total of 238 phenotypic data (173 Black Bengal, 50 Black Bengal crossbred, and 15 Jamunapari goats) were collected from 7 different regions namely Naikhongchari, Bhaluka, Rajshahi, Savar, Chuadanga, Meherpur, and Kushtia. All sorts of descriptive statistics were performed using the agricole package in R and Mean separation was tested using pastecs package in R. The Bone morphogenetic protein 15 (BMP15) and Growth Differentiation Factor 9 (GDF9) genes were used as candidate gene to evaluate the prolificacy trait of Black Bengal goat. The sequencing analysis revealed three SNPs in exon 2 of the BMP15 gene, including g.5875A>G, g.6051G>A and g.6124C>G, and only one SNP in exon 2 of the GDF9 gene, g.3764C>T. The GDF9 gene's polymorphism g.3764C>T was non-synonymous in nature, changing the amino acid alanine to valine (A273V). Besides, BMP15 had only one non-synonymous mutation (g.6124C>G) that resulted in the amino acid, glutamic acid being changed to glutamine (E270Q). The genotypic and allelic frequencies differed largely for each SNP genotypes. In addition, the derived genotypes of three BMP15 polymorphisms showed a significant ($P<0.05$) association with litter size at third kidding and average litter size. Therefore, both candidate gene could be used as molecular marker for prolificacy trait improvement of Black Bengal goat upon validation with large number of samples.

Fig: Blood collection, sample processing, DNA extraction and PCR amplification

Molecular identification of the black bengal goat in Bangladesh using DNA barcoding

DNA barcoding technology has been used for identification and classification of different taxa and has successfully identified new species and varieties. Mitrochondrial DNA sequences have mamy advantages as molecular marker. A DNA barcode based on the D-loop region has been used for species identification in goat varieties. The goal of this study was to identify DNA barcode for molecular identification and to protect Black Bengal goat and its genetic diversity. About 70 blood samples have been collected from 7 different project locations out of 8 locations. The mtDNA has been extracted from blood of each goats using phenol chloroform method. The DNA concentration and quality were determined by NanoDrop 2000 spectrophotometer and gel electrophoresis. PCR amplifications for each sample was performed in a final reaction volume of 50 µl consisting of 2 µl containing 100 ng genomic DNA, 25 µl premix, 1.5 µl of each primer (CAP-F: CGTGTATGCAAGTACATTAC and CAP-R: CTGATTAGTCATTAGTCCATC) and 20 µl ddH2O using reagents from Invitrogen. The PCR product was used for electrophoresis on a 1.5 % agarose gel and visualized by staining with ethidium bromide via ultraviolet transilluminator to confirm the amplification. Then PCR product was purified using PCR product purification and 40 µl of each PCR purified product was sent to the Molecular Biotechnology Division (NIB) for sequencing. Raw sequences were edited and trimmed out by using Mega11 to make homogenous fasta sequences. All of the samples were found positive where the overall detection of HVR1 by this primer set was 100%. Sequence analysis revealed 56 variable sites that defined 26 haplotypes. Haplotype diversity and nucleotide diversity were estimated 0.95020 and 0.01225, respectably. Furthermore, AMOVA analysis revealed 83.48 % of the total genetic diversity was accounted for within population variation. The median network and phylogenetic analysis indicated that individuals from all BBG populations were represented in the clade A, except Bandarban population, those maternal origins are presumed to be from Asian, more particularly Indian sub-continent. The goat population of Bandarban was in clade C indicating origin near to China. These results inferred that BBG still have abundant genetic diversity and have originated from multiple maternal lineages, and further conservation efforts are warranted to maintain the diversity.

Fig: Blood collection, processing and 638 bp D-loop amplification

Project title: Development of feeding strategy for different ages of black bengal goat

Sub-title: Replacement of concentrate through moringa foliage on the performance of yearling does

Black Bengal goat is famous for high fertility, prolificacy, and very good adaptability. Good balanced feeding prolongs the productive life of the doe, increases milk yield by the doe resulting in healthier weanlings and lessens the incidence of kidding paralysis. In recent years, moringa leaf meal is used as a protein source and feed components in animal production especially in goats. Considering the facts the present study was designed to replace the concentrate mixture with dried moringa in the diet of yearling does up to kidding aiming to know their productive and reproductive performance. The study was conducted in Goat Research Farm of BLRI, Savar, Dhaka. An animal feeding trial with 32 yearling does was set up with 8 replication of each where four dietary treatment (T_0 – 100% concentrate, T_1 – 80% concentrate + 20% dried moringa foliage, T_2- 60% concentrate + 40% dried moringa foliage and T_3 - 40% concentrate + 60% dried moringa foliage) was maintained with adlib grass. Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 23.0. The average dry matter intake of T_0, T_1, T_2 & T_3 treatments were 502.80, 506.58, 546.50 & 421.88 respectively. The average CP intake of T_0, T_1, T_2 & T3 treatments were 185.97, 184.96, 182.20 & 137.51 respectively. Highest growth rate (34.80 gm/day) was found in T_2 group compared to others group. Animal of T_1 and T_2 group shows first heat earlier than other two groups. The average postpartum heat period of T_0, T_1, T_2 & T_3 treatments was 38.0, 40.17, 42.12& 48.0 days respectively. Litter size comparatively higher as first parity goat for T_0, T_2 and T_3 groups reported by others. Lower litter size ($p<0.05$) observed in T_1 group may be due to the individual animal effects. In case of kids birth weight there is no differential effect on T_0, T_1 & T_2 diet. Does fed with T_2 diet had higher milk yield than the other treatment groups. Finally, 40% replacement of concentrate with moringa foliage (T_2) alone with green grass as basal feed performed significantly better and it could be used as protein supplement for lactating goats at small holder farmers' level.

Fig: Concentrate & moringa foliage

Fig: Black bengal goat

Project title: Improvement of feeding system of black bengal goat in different selected areas of Bangladesh

Sub-title: Nutritional assessment of some selected tree fodder for goat feeding

Black Bengal is a promising dwarf goat breed known to be famous for its high adaptability, fertility, prolificacy, delicious meat and superior skin. But nutritional status of Black Bengal goat in Bangladesh is not so good due to the shortage of feeds and fodder both in quality and quantity. The feeding practice in Bangladesh for goat feeding is not suitable for better productivity of Black Bengal Goat in terms of nutrition, reproduction and health status. In this context, introducing of suitable tree leaves as supplementary feed may contribute a potential role to meet the growing demand. So, the present study was undertaken to identify and evaluate the available tree fodder mostly used for goat feeding and to introduce tree leaf or fodder based feeding system for goat. A survey was conducted to know the mostly used tree fodder for goat feeding. A representative amount of widely used tree leaf samples were collected to analyze for both nutritional and anti-nutritional (tannin) value. Proximate Analysis and in vitro gas production technique was performed at Animal Nutrition Laboratory, BLRI and analysis of tannin was done at Bangladesh reference Institute for Chemical Measurement (BRICM) laboratory. The level of CP, one of the essential nutrients for productivity, is promising in jackfruit leaves (13.84%), but Ipilipil and Hilinchi are two surprising sources of CP (23.8 and 21.1%) among the leaves of the selected trees. The tannin content of all the selected leaves was analyzed. Higher tannin content was observed in Mango (1.69%) and Mehegony (1.4%) where the lower was in Jackfruit (0.08%) and Hilinchi (0.05%). Intermediate level of tannin was found in Ipilipil (0.82%) and Banana (0.84%) In terms of quality, Ipil Ipil can be recognized as a supreme quality tree fodder and jackfruit and banana leaf as next in line tree fodder whose respective digestibility (%) and ME (MJ/Kg DM) value is 71.72, 68.13, 64.04% and 9.4, 8.57, 7.91 MJ/Kg DM, respectively. Finally, it can be said with certainty that there is a profound ability of tree leaves to ensure production efficiency as supplementary fodder in goat diet but further more research need to be done in terms of animal performance, processing and so on.

Project title: Fettening of castrated male goat in Bangladesh

Sub-title: Effect of complete pellet feed on the growth, carcass & meat quality characteristics of different age group of castrated Black Bengal Goat

In the context of Bangladesh, feeds and fodder scarcity is the major problem for better livestock production due to rapid decline of grazing land. Straw-based pelleted TMR is an innovative technology that minimizes the scarcity problem of feed and improve DMI and production performance of animal. Previously the effect of complete

pellet feed on goat production research was done at BLRI but there is no study of the effect of pellet on goat fattening. Considering the fact, the present experiment was designed to know the effect pelleted TMR feeding on the fattening and carcass characteristics of goat at Goat Research Farm of BLRI. A total twenty four (24) healthy castrated male goat of 3 months of age of with similar body weight were divided into two groups where sixteen (16) goats in treatment group (T_1) and remaining eight was in control group (T_0). The pellet was supplied as adlib basis having nutritional value of DM 91.6%, 16.43% CP, 23.69% ADF and 45.13% NDF and 7.26% ash. Simultaneously, a control group was reared with grass-based feeding. The initial body weight of the experimental animal was recorded at the beginning of the experiment and subsequently at 7 days interval in the morning body weight was recorded before feeding and watering. Data were analysed using Statistical Package for the Social Sciences (SPSS) version 23.0. The ADG was almost 50% higher (73, 75 and 60 gm/day) for pellet feeding group compare to grass feeding group (37, 38 and 32 gm/day) and FCR significantly reduced in pellet feeding pellet feeding group although CP intake not differ significantly between the groups for 06, 09 & 12 months of age respectively. Significantly higher meat yield parameters like, warm carcass weight, dressing percentage and meat:bone ratio were also observed in pellet feeding group both for 06, 09 & 12 months of ages but only meat:bone was decline in 12 months of age of both group. Most of primal cut values significantly higher in pellet feeding group for both ages compare to grass feeding group. The results of physico-chemical attributes of goat meat like color intensity, water holding capacity, drip loss etc. was better in pellet group. Although all the carcass characteristics was better in 12 months of age but for increasing fat percentage it was suggested that 9 months of fattening time helps to enhance profitability without any negative impact on meat quality.

Poultry Strengthening Research & Development Project

Production of value-added poultry meat through dietary manipulation of selected herbal plants

An experiment was conducted to evaluate the effects of *Linum usitatissimum* (Flaxseed) with Moringa *oleifera* leaf (Moringa) on carcass quality, fatty acids profile and oxidative stability in broiler chicken. Cholesterol separation was conducted by Agilent 8890 with an HP-5 capillary column and a flame ionizing detector (FID). Broiler chicks were assigned to four dietary treatments as follows: T_1-control diet; T_2-flaxseed 0.5% + moringa1%; T_3-flaxseed 1%+ moringa 1%; and T_4-flaxseed 1.5% + moringa 1%. The final body weight gain was similar in all groups in 35 days with significantly ($P < 0.05$) reduced feed intake in T_4 than control. The TBARS values of meat were reduced in the flaxseed and moringa-added groups ($P < 0.05$) than the control. Cholesterol content in thigh meat decreased significantly ($P < 0.05$) in T_3 and T_4 groups compared to the control. In breast and thigh meat, the sum ω3 fatty acids were higher, alongside significantly increased polyunsaturated fatty acids, and a lower ω6/ω3 ratio except T_2 group was observed in flaxseed and moringa added group ($P < 0.05$) in thigh meat. The broiler breast and thigh meat samples were preserved in a refrigerator at 4°C to determine the oxidative stability. Thiobarbituric acid reactive substances (TBARS) values of meat samples were assayed at 0, 4, 7, 14, 21, and 28 days. It was shown that TBARS values of broiler thigh meat (T_2 group) with the value of 9.95µmol MDA/100g was significantly lower at 14 days compared to the control 25.95 µmol MDA/100g. However, after 21 days, both breast and thigh meat values were significantly lower than the control group. Overall, the results presented here indicate that the addition of diets with up to 1.5% flaxseed with a combination of moringa 1% improved the meat composition, ω3 fatty acid, and reduced lipid oxidation of broiler meat.

Fig. 1: Broiler trial

Fig. 2: Banner of Safe Broiler research shed

Fig. 3: cholesterol analysis by Agilent 8890

Productive and reproductive performances of ostrich in Bangladesh

The objective was to study the physical and chemical quality of ostrich egg and was to observe dietary effect of different amino acids (Lys, Meth.) on growth performance of ostrich chicks. Under farming conditions no of egg laid= 16-25 eggs, weight of the egg (g) 1466.67±88.19, Ostrich egg =more oval, Shape Index= 81-85%, egg shell = cream colored and glossy, shell thickness= 1.55- 2.2 mm, breaking strength= 55kg/ cm^2. Age of puberty (years)- 2.00± 0.25, Ratio of male: female= 1.75± 0.25. Results showed that, Glutamic acid and methionine are absent in albumen as well as cysteine absent in yolk but Aspartic acid, Serine, Valine, Leucine, Tyrosine, Phenylalanine, Histidine remain higher in albumen and Threonine, Alanine, Lysine, Arginine, and Proline are found higher in yolk. Lastly Cholesterol is less in ostrich egg which likely 492.41±30.89 (mg/100). Twenty-four Ostrich chicks (*Struthio camelus*) aged one week were brought for research from South Africa to the Poultry Research Center, BLRI, Savar, Dhaka and reared under semi intensive system. The formulated ration was supplied along with *ad-libitum* roughages to the control group (T_0), While treatment groups T_1, T_2 and T_3 were supplied with added methionine 0.3, 0.4, 0.5 and lysine 0.8, 1.0, 1.2 percent in feed respectively. The data stated that initial body weight (g), feed intake (g/day), water consumption (ml/w) and feed conversion ratio (FCR) were found 6480±151, 47896.84±1633, 105190±1040 and 2.05±0.053, respectively. The body measurements at different parameters of ostrich were highly significant ($P< 0.05$). High positive correlations between live weight and other parameters were measured (neck diameter and length, shank diameter and length, wing and body length, heart girth and bird height) in treatment group 3. Finally, it can be said that Extra addition of 0.5% methionine and 1.2% lysine with the formulated concentrate feed has showed numerically higher growth rate.

Quality and safety assessments of poultry meat products in Bangladesh

Sub-Title: Availability and consumption of chicken meat products in Chattogram town

Today, chicken meat products are getting popularity among city dwellers. Chattogram is the largest port city and is oriented with the varieties of Super Shop, Franchise Outlet, and Fast-Food Shop whereas chicken meat products are available. The objectives of the study were to find out the available chicken meat products in Chattogram town and their consumption pattern at the consumer level. We considered three different areas for data collection. The first one was Super Shop, the second one was Franchise Outlet and the third one was Fast Food Shop. The chicken meat products supplier companies of Chattogram are Kazi Foods, Aftab, Paragon, Golden Harvest, Country

Natural, AG Food, Mafco, Roja, Jhotpot, Basket, ATR, Essentials, Basket, Shwapno, Tava, Quality, Ramly (Malaysian) and Iyam (Brunei).Chicken Nugget, Chicken Sausage, Chicken Meatball, Chicken Spring Roll, Chicken Noddles, Chicken Hot Wings, Chicken Singara, Chicken Samosa, Chicken Burger Patty, Chicken Kebab, and Chicken Lollipop were the available products in Super Shop. The weekly sale was 300 kg for Basket, 280 kg for Khulsi Mart, 250 kg for Shwapno and 200 kg for Agora. When it was compared the data in these four super shops, it was shown a highly significant difference ($p<0.001$) for weekly sales. The highest salable product was Chicken Meatball (44.48 ± 6.68) kg per week and the lowest salable product was Chicken Noodles (15.00 ± 0.42) kg per week. In the case of Franchise Outlet: CP Five Star, Kazi Farm Kitchen, Golden Harvest, Basket, and Essentials were selected. After analyzing the data, it was found no significant difference for weekly consumption The Fast Food Shop was Ammazan Fast Food Shop, Eat Out, Street Café and Jhalmuri Fast Food Shop. Through comparing the data into these fast food shops, it was also found no significant difference for weekly consumption. Finally, it may be concluded that further study is needed to explore the chicken meat products market in Chattogrami town.

Performances of native and exotic chicken lines under ex-situ production environment for selection as parent lines

That study undertaken to develop a meat type chicken by crossing native with exotic breed which produces comparatively more meat along with tastes similar to native chicken.The objectives were to select best performing chicken lines based on growth, productive performance and meat quality parameters. Three native chicken genotypes(NL1, NL2, NL3) and three exotic chicken genotypes(EL1, EL2, EL3) were selected a number of 250 birds of each upto 40th week of age.Birds were fed with recommended nutrient and identified. All data were recorded individually. Lowest feed intake found in Line 3 (40.07 g) whereas highest in Line 2 (41.84 g) upto 10 weeks of age, at 11-20th week lowest in Line 2(91.44g) and highest in Line 1(92.44g).Whereas in Exotic lines lowest feed intake found in lines I (38.12g, 88.17g,101.4g,) and highest in Line 2(40.99g, 91.9g,102.03g) at consecutive weeks.In native genotypes lowest body weight found in Line 1 (29.2g, 278.7g, 586.08g, 920.81g, 1567.06g and 1729.12g) in doc, 4th ,8th, 12th,20th and 40th weeks of age and highest in Line 2 (26.46g, 280.02g, 692.19g) at doc, 4th, 8th weeks and in Line 3(1254.74g, 2107g and 2970.53g) at 12th, 20th and 40th weeks of age. In exotic genotypes lowest in Line 2(29.27g, 173.36g, 681.31g, 887.04g, 1511.13g) and Line 1(1875.55g) at 0, 4th, 8th, 12th 20th and 40th weeks of age and highest in line3 (30.3g, 342.94g. 757.61g, 1078.48g, 2027.22 and 3210.82g).Lowest Age at onset of lay , highest fertility and Hatchability was found

In Line 1(135.5 days), Line 2 (89.07%)and Line 3(88.29%), lowest mortality in Line 3(0.94%) and highest egg production in Line 1(120nos) in native lines. In Exotic chickens Line 3(124.4days, 88.84%, 62.96%, 0.54,190nos) performed better.So native line 1 and 2 and exotic line 2& 3 performed better at marketing age (12th week) as well as reproduction.

Recycling of poultry wastes for environment friendly low cost poultry production

The study was conducted to estimate the amount of poultry dressing and hatchery wastes produced in Bangladesh and at Poultry Research Centre (PRC), BLRI, and assessing their nutritional value; to develop locally made hatchery wastes processor, and to know the efficiency of bio-gas production in the biogas plant at PRC. The backward and forward calculation was done from the Day-old chick production of commercial broiler, layer, Sonali and colour broiler in Bangladesh. To process the hatchery wastes in a smarter and convenient way, a prototype processing device was designed using locally available materials and techniques. The device run on trial basis and found suitable to get processed hatchery waste meal. The meal also underwent for proximate, microbial and heavy metal tests. The yearly estimated poultry processing and hatchery wastes produced in Bangladesh and at PRC, BLRI was 6 lakh and 40,000 MT and It was 2.7 and 1.5MT, respectively. The moisture, dry matter, crude protein, crude fiber, ether extract and ash content of hatch out waste meal, infertile eggs waste meal, and offal meal was 2.37-8.75, 91.25- 97.63, 18.42-24.94, 3.0-11.45, 2.8 -9.4 and 26.1-50.85; 1.7-3.52, 96.48- 98.3, 17.05-20.47, 10.25-15.20, 5.6 -17.0 and 23.27-33.25, and 12.52, 87.48, 62.67, 0.90, 7.04 and 8.46 percent, respectively. Most of the samples were not detected the heavy metals or found trace amount except for "Pd" and "Cd" and It was found as permissible limit. (Adekanmi, 2021). All tested samples were found negative for *Salmonella Spp.* But there was found *E. coli* and coliform with varying quantity from 750 -1480 CFU/ml. The successful biogas production was observed using burner and generator. In conclusion, a significant progress was achieved for poultry waste processing area and the study is on-going.

Fig: Hatchery waste Processor

Fig: Processed meal

Fig: Biogas plant activities

Fig: Biogas run generator

Phenotypic and genotypic characterzation with meat quality assment of hybrid duck produced through three-way crossing in Bangladesh

Sub-title: Performance evaluation and crossbreeding effects of local, exotic duck and their hybrid (F1) under the semi-intensive system in Bangladesh

This study was conducted to evaluate the performance of exotic (Pekin), local (Rupali) duck (*Anas platyrhyncos*) and their F1 crossbred duck under the semi-intensive system in Bangladesh, for growth, morphology, and meat yield characteristics. The experimental results were measured at the treatment ages of 8th, 10th, and 12th week. Rupali and Pekin's dominant extended white gene was expressed in F1 hybrids. The hybrid had the same abdominal color as the parent genotype, which had a white head, wing, and breast hue. With genotypes of 1480.87 g, 2185.56 g, and 2047.67 g, Rupali, Pekin, and their crossbreds showed significant growth performance up to 12 weeks of age when subjected to intensive management. The mortality rate at 12 weeks was 3.37 %. For measuring meat yields, such as drumstick with thigh weight, hot carcass weight, dressing percentage and breast meat weight, indicated significant differences between Pekin and Pekin x Rupali crossbred duck ($P < 0.05$). Effect of heterosis on carcass parameters of PR cross showed negative heterosis for body weight, neck, drumstick, abdominal fat, wings, total fat, thigh and the edible meat parts (-7.54, -14.72, -14.43, -32.55, -0.6, -6.28 and -4.8% respectively), however, there was positive heterosis for dressing, liver, breast meat, skin fat and giblets (3.32, 9.01, 6.75, 2.17 and 12.62% respectively). Concerning breast muscle, the PR cross recorded positive heterosis for major and minor muscles. This crossbred genotype possesses 50% native inheritance and therefore, adaptability would be expected higher under hot and humid conditions of Bangladesh compared to exotic Pekin duck. Therefore, it may be better to introduce desirable genes from Pekin to progeny by crossing desi and egg-type females with Pekin males.

Fig: Some pictorial views of projectes activites

Collection, conservation and improvement of specialized fowl (Turkey, Guinea fowl and Pigeon) production at BLRI

The present study was conducted from July 2022 to June 2023 to introduce and conserve available varieties of Turkey, Guinea fowl and Pigeon at BLRI research farm and to evaluate their productive and reproductive performance so that suitable variety/breed of these species can be determined. There are four turkey varieties, four guinea fowl varieties and six pigeon breeds. Data were analyzed using the SAS (version 9.4M7, 2020). In case of Turkey, Bronze variety had higher body weight from 4 to 20 weeks (3231.60±106.16 g at 20 weeks), better FCR (1.67-2.23 from 4-12 weeks), better hen day egg production percentage (38.32±5.10), fertility percentage (84.67±0.67), higher dressing percentage (64.94±0.003) and higher CP percentage was exhibited in Bronze (26.28±0.58), White (26.72±0.58) and Black (26.44±0.58). Red variety of Turkey had better average weekly gain, hatchability percentage (70.43±0.58) and White variety had better egg weight (75.86±1.25). In case of Guinea fowl, Pearl variety had higher body weight from 4 to 20 weeks (1169.40±20.75 g at 20 weeks of age), better egg fertility percentage (65.72±6.10), hatchability percentage (76.75± 3.88), dressing percentage (67.6± 0.013), higher CP percentage was found in Pearl (26.35± 0.58) and Lavender (25.82± 0.58). Lavender variety had better hen day egg production percentage (33.46±9.92) and egg weight (33.12 g). In case of Pigeon maximum body weight was exhibited in both male (556.67±21.53 g) and female (539.33±15.53 g) in King breed of Pigeon. Therefore, Bronze variety of turkey outperformed the other varieties in terms of growth and egg production. Pearl variety of guinea fowl exhibited better growth whereas egg production related traits were better in Lavender variety than other varieties. In case of Pigeon, King breed of pigeon displayed maximum body weight whereas our local Golla and Giribaz had the lowest body weight. However, further conclusion will be made after the completion of the investigation.

Conservation and development of native geese production package by determining feed requirement with supplemental forages

The present study was designed to assess the efficacy of water spinach (*Ipomoea aquatica*) in determining the slaughter and carcass traits, meat color, pH, drip loss, cooking loss, water holding capacity & meat nutrient composition of native Bangladeshi white and grey geese varieties supplemented with different proportion of water spinach. A total of 36 adult geese from white and grey varieties were reared in a semi-intensive production system and slaughtered at 28 weeks of age. They were randomly divided into 4 groups with 3 replicates having 3 geese in each replication. Maize soya-based diet was considered as control diet (2700ME/Kcal, 16% CP) where T1 & T3 group were given 180 gm of CL diets in white and grey variety and other diets included T2 (White variety)- 80 gm of water spinach + 140 gm of CL diet, T4 (Grey variety)- 80 gm of water spinach + 140 gm of CL diet. At the end of rearing, all the birds were individually weighed. The pH values of the breast meat 24 hours of post-

mortem, meat color, drip loss & cooking loss was determined scientifically. The data of the variables collected were statistically analyzed using the general linear model procedure of SPSS software (29 version) following a random arrangement. Treatments had a remarkable effect ($P < 0.05$) on redness value (a^*). A total of 13 slaughter traits divided into 2 groups- measured and calculated traits- were statistically analysed. For measured and calculated slaughter traits, results suggested that beneficial traits were not significantly varied but tented to be higher in treatment group. pH value for T3 group was higher than other groups. Additionally, treatment group showed highest drip loss and cooking loss and water holding capacity, but these parameters were not significantly affected by treatments.

Fig: White variety

Fig: Slaughter traits

Fig: pH

Fig: Drip loss

Demonstration and validation of BLRI developed native duck through community based at Bhanga, Faridpur

The present study was conducted from July 2022 to June 2023, to validate the production ability of Rupali and Nageshwari ducks compared to locally rear native ducks under farmer's condition. Eggs of Rupali and Nageshwari were distributed to the rural women from BLRI regional station duck shed. Eggs were hatched by natural brooding and BLRI native duck trial was conducted at community level at Bhanga, Faridpur. Their productive & reproductive performance was recorded. This study shows that hatchability of Rupali duck was 70% whereas Nageshwari was 68%. Egg production & age at sexual maturity of Rupali was 160 eggs & 180 days respectively, whereas Negeshwari was 150 eggs & 175 days. Dressing %, duckling weight, culling weight & egg weight of Rupali duck was 60%, 50.07 gm, 1.65 kg & 66.70 gm respectively in comparison with Nageshwari duck. Rupali duck had better culling weight and egg weight than Nageswari duck. Rupali had also high egg production in compared to Nageshwari duck. The productive & reproductive performance of Rupali duck is higher than Nageshwari duck at community farm level.

Fig.: Trial Shed ar Bhanga, Faridpur

Fig.: Rupali

Fig. : Nageshwari

Assessing the effect of lactic acid bacteria postbiotics on improving quality and safety of broiler meat

This study was screened and identified bacteriocin-producing lactic acid bacteria (LAB) and optimized and characterized bacteriocin-like inhibitory substances (BLIS). Five commercial LAB strains and seven meat spoilage bacteria were used as producer and indicator bacteria. Cell free supernatant (CFS) containing BLIS and neutralized CFS (NCFS) of LAB strains were utilized. All five LAB strains generated potential antibacterial compounds and inhibited indicator bacteria (15.17 ± 1.32 mm to 23.05 ± 0.95 mm ZOI). *Lb. plantarum*> *Lb. acidophilus*> *Lb. rhamnosus*> *Bifido. animalis*> *Lb. casei* were graded based on their CFS activity. The antagonistic action of BLIS were confirmed with lower NCFS's activity than CFS. BLIS were proteinaceous since trypsin and pepsin reduced activity in CFS. BLIS activity varied from 160-1280 AU/ml with MIC value of 1.54-12.50 mg/ml, while *Lb. rhamnosus* GG showed highest BLIS activity (1280 AU/ml) and lowest MIC (1.54 mg/ml) against pathogens. BLIS production started with an average 15% inhibition during the early exponential stage, peaking at 30°C for 20-28 h and 37°C for 20-24 h. LAB strains produced active CFS at 36 h at 30°C and 24 h at 37°C with >85% pathogen inhibition. BLIS lowers activity by increasing incubation time (16 h versus 24 h) and storage temperature (-22°C versus 4°C) formone month. BLIS was stable at 60-100°C for 30 min and 121°C for 15 min, at salt concentrations from 2 to 10%, and acid-base in pH ranges from 4-7 and 7-11, but sensitive to pH > 7. The recovered CFS, NCFS, and lyophilized CFS contained metabolites (mg/ml) of lactic acid, protein, and hydrogen peroxide. Compared to lyophilized CFS (LCFS), CFS had higher lactic acid and protein levels (P> 0.05). Time-killing assay showed that the BLIS killed 73- 78 % of *E. coli* and 65-71% of *S. aureus* within 20 h of exposure.

Fig: Screening, identification and characterization of antimicrobial substances derived from 5 commercial LAB strains. A) antimicrobial substances (AS); b) screening and identification of bacteriogenic LAB; c) optimization and characterization of AS and d) Final analysis of data using UV-Vis.

Community involving economic diseases control model for chicken

The study was carried out in the first year (2022-2023) to unveil the status of economically important diseases (especially ND) in backyard chickens of a community and to determine the sero prevalence of ND in backyard chicken. The project site was selected at Nowapara village under Bhanga Upazilla, Faridpur. A baseline survey was completed over 100 backyard poultry households from door to door with the

predesigned and pretested questionnaire. After completing the baseline survey, 50 beneficiaries were selected randomly from this village.Sero surveillance of ND before and after vaccination was done using Haemagglutination (HI) assay (β method).The survey result showed that on average 25%, 17%, 33%, and 25% of farmers were illiterate, class one to four, class five to class nine, and SSC or above respectively. The distribution livestock population was 51%, 25.31%, 17%, 4.13%, 2.47% for indigenous chicken, duck, pigeon, cattle, and goat. Maximum farmers (Above 80%) were faced with different types of diseases in their birds especially ND, avian influenza, fowl pox, coccidiosis with high mortality rate, and low productivity of native birds. Only 6% of farmers use anthelmintic irregularly for their birds, 9% of farmers dispose of their dead birds in soil pits and others dispose of slaughtering waste and carcasses in environments. More than 80% of farmers don't practice vaccination schedules. Floors of the poultry houses were made of 5% concrete, 77% wooden, and 18% soil-made which were mostly found as very dirty and unhygienic. Sero surveillance of ND before and after vaccination of a total 42 birds (16 serum samples for pre-vaccinated and 26 samples for post-vaccinated) were done using Haemagglutination (HI) assay (β method). The results of Ab titer level of HI test showed <8 in 87.5% for pre-vaccinated birds whereas Ab titer level of HI test showed >16 in 78% for post vaccinated birds. Hence, vaccinated birds of 78% were in protective condition against ND.

Fig. Some pictorial views of the project's activities

Screening and utilization of edible insect as a protein source in poultry diet

In poultry production, feed cost is approximately 60 to 70% of the total cost. From last few years feed cost is increasing very rapidly. Searching a new or alternative low cost but high quality protein feed source is demand for poultry feeding in our country. This new research was launched at Bangladesh Livestock Research Institute (BLRI). There are different types of insects are also available in Bangladesh like silk worm, termites, black soldier fly (BSF), pupae larvae, housefly larvae, grasshopper etc. Based on literature we have initially screened out and collected black soldier fly larvae (BSFL), pupae and fly sample from different locations of Bangladesh and tested in our lab to find out the protein content. We have also collected pupae from Sky Agro Ltd. in Kushtia for production of larvae at BLRI. We have used different substrates like faeces, vegetables and faeces-vegetable mixed to study the proximate analysis

of larvae. Broiler meat sample from field were collected after feeding BSFL larvae with commercial feed only to know the proximate composition of meat samples. Result showed that crude protein (CP) percentage is higher in fly stage (58.70%) than pupae (38.59%) and larvae (36.95%) and highest CP percentage is found in feces and vegetable mixed substances (38.66%) than poultry feed (34.03%), feces (38.64%), vegetables (37.42%) and egg (38.56%). It also found that, CP, fat and ash were higher; 41.53%, 16.40% and 23.75% respectively in faeces and vegetables (75:25) mixed media compare to other mixed media but crude fibre (4.25%) is lower than others. However, this study focuses on the documentation of the proximate nutrient composition, Impact on the animal feed industry, consumer acceptance, and safety of insect meal as animal feed. Among different levels of the substrate Faeces: Vegetable waste ratio (75:25) showed better in terms of crude protein content (CP), crude fiber (CF), ether extract (EE) and ash content

Fig-1: Culture media for BSF

Fig-2: BSF Larvae

Fig-3: Black Soldier Fly (BSF)

Fig-4: Lab test of BSF

Buffalo Research and Development Project

Performance evaluation of crossbred buffalo under on-station and on-farm conditions

The study was undertaken i) to evaluate the productive and reproductive performance of crossbred buffaloes under on-station condition and ii) to develop a feeding regime for attaining puberty between 24 to 28 months of age of buffalo heifers. To achieve the above-mentioned objectives, the activities of producing F_1 crossbred buffalo calves (50% Murrah x 50% Local) through artificial insemination or naturally mated at BLRI Buffalo Research Farm. Moreover, a feeding trial of twelve crossbred heifers was conducted and randomly divided into three equal groups; T_1 (Grazing + concentrate mixture@1% of body weight), T_2 and T_3 (*Adlibitum* green roughage + 10% higher ME compared to the NRC standard ration and 15-16% CP) having 4 animals in each group based on their different body weight (332.66 vs 215.25 vs 173.75 kg) and age (29.25 vs 19.25 vs 16.43 months). The feeding trial was continued for nine months. Data on body weight, age at first heat, calving interval, gestation period, disease incidence and blood samples were collected and analyzed using SPSS program. Result showed that body weight of crossbred buffaloes at birth, 3, 6, 9, 12, 15, 18, 24 and 30th months were 29.26, 59.5, 113.33, 179.56, 212.63, 238.65, 255.96, 293.28 and 351.73 kg, respectively. Age at first heat, age at first calving and gestation period were 1142.9, 1450.4 and 307.5 days, respectively. The overall calf mortality was 8.13. On the other hand, the result in feeding trial showed that age at first heat was found delayed in group T_1 (36.53 months) and earlier in group T_2 (27.35 months) and T_3 (24.5 months), respectively. Body weight at the age of puberty was higher in group T_2 (379.3kg) followed by group T_1 (362.75kg) and T_3 (323.0kg). Body weight gain of crossbred heifers during the trial period was found higher in group T_2 (0.60 kg) followed by group T_3 (0.50 kg) and T_1 (0.15 kg). Significantly lower in glucose level but higher in triglyceride was found in group T_1 compared to group T_2 and T_3. Significantly lower creatinine and ALT but higher GGT was found in group T_1 compared to group T_2 and T_3. Considering the above finding, this study summarized that early puberty in buffalo heifers may be attained with better management practices at an early stage.

Conservation and Improvement of Indigenous buffalo for milk production through open nucleus breeding program

The study was undertaken to improve dairy performance of indigenous river buffalo through selective breeding using open nucleus breeding system and to conserve indigenous buffalo for maintaining indigenous germplasm as a part of maintaining bio-diversity. For this study, 1000 buffalo cows of daily milk production (over 3.0 liter

per day) and parity (maximum 2nd) were selected from selected 550 farmers and 8148 heads buffaloes. About 5134 heads were tagged (63.19%) and 2836 buffalo's information was updated in "Digital Database for Buffalo Research". From the study, significantly (P<0.05) higher body weight of calves at birth (27.3 vs 23.3 kg), 1 month (38.5 vs 33.5 kg), 3 months (61.9 vs 51.1 kg) and 6 months (81.3 vs 77.1 kg) were found in the char than coastal area. Daily body weight gain of calves was found higher in the char (0.40±0.01kg) than coastal area (0.37±0.03kg). Age at puberty was found earliest on station and delayed on farm (31.5±1.4 vs 36.92±0.4 months). A similar trend was observed for age 1st calving (42.9±1.5 vs 48.16±0.4 months), calving interval (14.1±1.4 vs 14.91±0.2 months) and service per conception (1.2±0.05 vs 1.4±0.04). BLRI herd had significantly higher (P<0.001) total adjusted 300 day and av.daily milk yield (1032.15±37.1 and 3.44±0.08 kg) than on farm (814.22±15.8 and 2.71±0.08 kg). Significantly (P<0.05) higher milk protein, lactose and lower milk fat and SNF were found in the BLRI herd compared with on-farm.

Fig-2: Data in software, body weight measurement and milk composition analysis

Significantly (P<0.05) the highest buffalo milk yield (3.36±0.06 kg), milk protein (3.71±0.02%) and lactose (5.50±0.03 %) were found in 4th parity but the highest milk fat (7.91±0.08 %) was in the 3rd parity. Significantly (P<0.001) the highest milk yield (3.25±0.05 kg), milk protein (3.72±0.03 %) and lactose (5.47±0.03%) were observed in the early lactation stage. However, the highest milk fat (8.50±0.08%) was found in late lactation stage. It was concluded that variation in body weight in char and coastal areas might be nutritional and individual genetic variation. The milk yield and its composition were influenced by the herd, parity and stage of lactation of buffaloes.

Development of buffalo fattening model for quality meat production

Running Title: Development of community-based buffalo fattening program

Buffalo bulls 2 years of old were selected and evenly divided into two group; group A (n=6) and group B (B=6). Their average initial body weights were 189.17±24.71 and 188.67±28.64 kg respectively. At the onset of feeding trial, bulls were de-wormed for

Internal parasites and vaccinated against contagious diseases (FMD and HS). The feeding trial was continued for a period of 120 days including a 15 days conventional feeding trial. Rations were supplied to Group A: Concentrate 30% + UMS 70%; and Group B: Concentrate 15% + UMS 85%. The dry matter (DM) and crude protein (CP) content of UMS and concentrate mixture used in experimental ration were 57.15 vs 88.10%, and CP 9.27 vs 18.08%, respectively. The bulls were weighed at fortnightly, and their feed intake, FCR, growth performance and cost-net profit were analyzed. Feed intake, growth, feed conversion efficiency and net profit of buffalo bulls were also analyzed. Result showed that dry matter intake of group A 8.15 (kg/d) were significantly ($p<0.05$) higher compared to group B (7.17 kg/d). There was no significant ($p>0.05$) difference of initial and final body weight between treatment groups but final body weight was higher in group A (281.17 kg) than group B (257.92 kg). Average daily body weight gain was significantly higher ($p<0.05$) in group A (0.767 kg) than group B (0.577 kg). Significantly ($p<0.05$) feed conversion ratio (FCR) was lower (7.12) but total cost/Kg gain was higher in group A (383.35 BDT) compared to group B. Net profit was significantly ($p<0.05$) lower in group A (6131.80 BDT) compared to group B (8111.95 BDT). Considering the above findings, it may be concluded that UMS with 15% concentrate diet should profitable for buffalo fattening.

Development of feeding and nutritional management practices for optimization of dairy performances in buffalo

This study was carried out to identify the rearing scenario and existing feeding management practices in Bauphal, Companyganj and Gangachara. In addition community based feeding trial to find out the suitable and low cost production management of buffalo at Godagari, Rajshahi. A total of 30 lactating buffaloes ten in each group were categorized into three dietary treatments followed by completely randomized design; Control (T_0) - Existing feeding system (grazed in the bathan of mixed natural grass + 300g/day concentrate supplement); T_1- Grazing in bathan (Padma char, Rajshahi)+ 1.5 kg concentrate supplement containing 25% more CP and ME than T_0 group and T_2- 70% roughage + 30% concentrate supplement containing 50% more CP and ME than T_0 group. The survey results revealed that maximum farmers at Gangachara (61.76%) and Bauphal (82.35%) were practiced semi-intensive farming whereas at extensive (58.82) in Companiganj. The large herd size (nos.) was found in extensive system (28.16±13.74) compared to semi-intensive (17.35±10.48) and intensive (16.00±7.01) system. Higher birth weight was found in intensive farming (30.00±6.06 kg) system than semi-intensive (25.25±2.00 kg) and extensive system (25.53±2.58 kg), respectively. Lactation length (days) were higher in intensive system (230.00±10.95) compared to semi-intensive (224.41±14.49) and extensive system (216.25±9.39) and milk yield (kg) was higher in intensive system

(3.216±0.44) compared to others. Results from community based feeding trial showed that dry matter intake was lower (P>0.05) in T_0 (2.088±0.14) followed by T_1 (2.485±0.13) and T_2 (2.657±0.19) group. Higher milk yields (P>0.05) were recorded in T_2 group (3.180±0.52 kg/d) followed by T_1 (2.811±0.29 kg/d) and T_0 (2.118±0.57 kg/d) group. Due to improved feeding, milk productions were increased 50.14% in T_2 and 32.7% in T_1 compared to T_0 group. Milk fat contents (g/100g) were higher (P>0.05) in T_1 (8.818±0.55) compared to T_2 (8.200±0.92) and T_0 (7.890±0.87) groups respectively. However, protein, lactose and SNF content did not differed among the treatment groups (P<0.05). Milk fatty acid profile were not significantly (p>0.05) differed among treatment groups. Considering the above findings, it may be concluded that milk yield and composition of buffaloes were improved with increased supplementation of ME and CP in diet.

Epidemiological investigation of major buffalo diseases and evaluation of effectiveness of deworming against buffalo diseases in Bangladesh

Buffalo is one of significant livestock species of Bangladesh. The current study aimed to conduct epidemiological investigation for knowing buffalo disease prevalence and to detect on farm effectiveness of deworming for developing strategic deworming calendar. A cross-sectional survey was conducted regarding health care practices, diseases along with risk factors and treatment costs with pretested questionnaire at 11 buffalo pocket area of Bangladesh. Most of the buffalo farmers reported unfamiliarity with the importance of proper deworming (92.8%; CI: 91.62-92.83) and vaccination (99.2%; CI: 98.65-99.97) in farming practice. A total of 705 fecal samples of 4 different age groups (A=<1 year; B=1-3 years; C=3-6 Years; D=>6 years) were tested during the pre- and post-deworming period applying combined Triclabendazole and Levamisole drug. Among the nematodes, a high prevalence of Trichuris spp. and Strongyloid spp. was observed in the fecal samples. However, the prevalence of protozoa such as Coccidia spp. (28%) was higher than cestodes such as Moniezia spp. (20%) in post-deworming periods. Buffalo calves are more vulnerable to parasitic diseases than adults. Buffaloes should be dewormed during the rainy season and every 3-month interval to better control parasitic infestation in all age groups. According to the disease prevalence survey in the last 3 years of 10 project areas, infectious disease prevalence was higher than non-infectious diseases in buffalo farms. Results showed that the occurrence of FMD (41.3%) was highest among the infectious diseases, followed by HS (17.8%), others (8.5%), Mastitis (4.9%), Anthrax (3.4%), and BQ (2.7%). Among the metabolic diseases, Acidosis (20.3%) was higher in the project areas.

Impact of waste management practices in buffalo farm

Subtitle : Existing buffalo farm waste management practices in selected areas of Bangladesh

The study was undertaken to introduce existing buffalo waste management practices in Selected Areas of Bangladesh. To achieve the objective, a purposive survey on existing waste management practices was conducted in the five upazila under five districts namely; Companiganj, Noakhali; Bauphal, Patuakhali; Ishwardi, Pabna; Godagari, Rajshahi; and Chorfession, Bhola district. Survey data were collected from 200 buffalo-rearing farms. Results showed that the average herd size of buffaloes was 16.1±8.2, 31.7±23.7, 15.5±7.1, 11.3±5.6 and 17.8±17.3 in Godagari, Companiganj, Bauphal, Ishwardi, and Chorfession upazila, respectively.



Fig : Survey data Collection from Godagari, Ishwardi, and Companiganj Upazila

Among these five upazila, farmer practices the rearing systems of buffaloes were intensive (2%), semi-intensive (32%), and extensive (66%) farming system. The overall buffalo-rearing experiences of the studied farmers were 19.1±8.4 years. About 98.5±2.23% of farmers had no farm drainage systems. Farmer processes their buffalo dung through Solid storage (22.8%), Burned for fuel (29.9), Pasture (35.78%), Liquid/ slurry (8.5%), and Lagoon (3.02%). The average distance of buffalo shed from their residential area was 91.04±72.16 feet among the study areas. About 54% of farmers daily spread to their cropland from solid storage. Farmers cleaned their buffalo sheds once a day (52.5%), twice a day (46.5%), and three times a day (1.0%). The practical problems associated with farm waste management by farmers were lack of manpower (31.2%), lack of adequate space (16.5%), lack of relevant equipment/ machinery (8.5%), and lack of willingness (43.8%). Most buffaloes were reared in the semi-intensive and extensive farming conditions in the study areas. It may be concluded that knowledge developed during this study will help future planning for the country's buffalo farm waste management practices.

Adoption and economic analysis of improved feeding technologies of buffalo rearing in some selected char areas of Bangladesh

Subtitle: Analysis of Farmers' Willingness to Pay (WTP) and Perception for Improved Feeding Technologies in Buffalo Rearing: Evidence from Field Experiment

Livestock are living banks of money for farmers, while their inadequate nutrition severely limits productivity. Buffalo are commonly raised by free grazing in char areas, which hinders them from getting optimal nutrition. Considering the facts, the research was designed to analyze the farmers' willingness to pay (WTP) and perception, adoption, and dissemination of improved feeding (TMR, UMS, and UTS) in buffalo rearing. For the analysis of WTP, a total of 250 farmers were randomly selected from five Upazilas (Ishurdi, Ramgoti, Gangachara, Anowara, and Fenchugonj). Contingent Valuation Method (CVM) and the close-ended double-bound dichotomous choice question were used to assess WTP. The results revealed that the farmers' age (46.60±0.84 years), occupation (farming 86.0%), farm size (128.69±14.37 decimals), year of schooling (5.52±0.27 years), experience (17.73±0.93 years), family size (5.76±0.13). However, the annual family income and income from buffalo was BDT 702624±50288, and BDT. 331521±40496 respectively. The buffalo herd size was 11.52±0.98, and the rearing system was intensive (6.4%), semi-intensive (43.0%), and extensive (50.6%) found in the selected areas. About 11.2% of farmers used improved feed supplements for buffalo. The farmers were willing to pay for TMR: 50.4%, UMS: 45.2%, and UTS: 34.8% and mean WTP premium price per kg of TMR (highest: BDT 47, lowest: BDT 39), UMS (highest: BDT 27, lowest: BDT 20), and UTS (highest: BDT 21, lowest: BDT 12). The annual household income positively and significantly influenced farmers' WTP. However, the mean perception scores found ranged between 2.94 and 4.47 with values closer to 5 indicating more favorable perceptions of TMR, UMS, and UTS feeding technologies. Finally, the findings demonstrated that there was a demand for improved feeding technology and marginally favorable patterns of perceptions. It is recommended that to improve farmers' perceptions and WTP; training, technology demonstration and incentives should be provided.

In vitro embryo production of buffalo

The present research was designed to improve efficiency of IVEP with OPU (Ovum pick up) technology for collection of oocyte from superior donor buffalo cow and transfer *in vitro* produced embryo into recipient buffalo cows. To achieve these 10 buffalo cows were selected from BLRI Buffalo farm for OPU technology. To improve the efficiency of OPU pregnant mare serum gonadotropin (PMSG) was administrated

into buffalo. From the study, it was revealed that the size of the left ovary ranged from 20.4±0.6 to 21.5±2.6 mm and that of the right ovary was 20.15±1.9 to 22.3±3.4 mm.

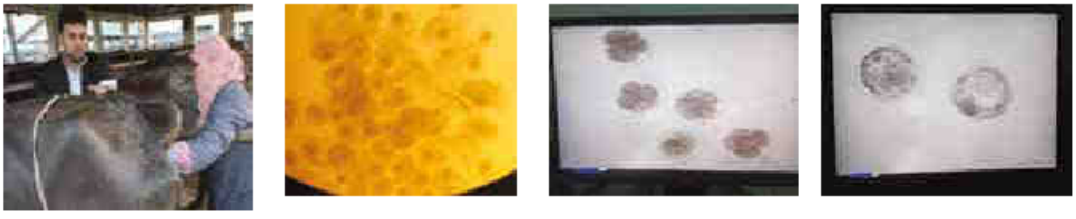

Fig : OPU adaptation, matured oocytes, cell division of embryos and blastocyst

Before PMSG administration there was no significant difference between the groups in follicle size or follicle number at day 0 and day 14. But the significant difference (P>0.05) was found for large follicle diameter after 40 hour of PMSG administration at day 14 which were 11.83±0.8 mm (largest follicle size 13.5 mm) whereas 7.28±2.2 mm for control group (largest follicle size 11.6 mm). Also, the number of follicles was higher for the PMSG stimulated group than control that was 11 vs 7 considering both ovaries. 5 oocytes were aspirated by OPU from 2 PMSG treated buffaloes and 2 oocytes were aspirated from 3 control buffaloes. The right ovaries were found more active might be for its larger size than the left ovary. However, from the slaughter house ovary about 1401 COCs (cumulus oocyte complexes) were aspirated. A total of 1274 graded COCs were incubated for IVM (*In vitro* maturation). Around 1041 (82%) of COCs were expanded with cumulus cells. About 606 graded matured COCs were fertilized with cryopreserved semen. The cleavage rate was 452 (75%). After *In vitro* culture, it was found that about 362 (60%) were developed to 2 cells, 268 (44%) were to 4 cells, 159 (26%) were to 8-16 cells and 49 (8%) were to morula and 4 (1%) were developed to blastocyst. It may be concluded that after PMSG treatment follicular number and size both were increased.

Development of animal recording and genetic evaluation system to foster indigenous buffalo selection programme

The study was undertaken (a) to investigate on-farm buffalo recording systems both off-line and online (digital devices) with regards to evaluate growth, reproduction, milk yield, milk composition and disease incidence in indigenous buffaloes under the prevailing systems of their management; (b) to estimate (co)variance components and genetic parameters of economic traits of indigenous buffaloes and (c) to develop a dynamic genetic evaluation system for indigenous buffaloes for use in replacement animal selection (mainly breeding bulls). Farmers who own river type indigenous buffalo (es) were identified from BLRI, Savar, Dhaka; Godagari, Rajshahi; Ishwardi,

Pabna and Madarganj, Jamalpur and mature Indigenous females were individually identified, registered and all information was recorded in herdbooks. Data on a total of only 101 indigenous mature female buffaloes (22 from Jamalpur, 33 from Pabna, 8 from BLRI and 38 from Rajshahi) were collected and are available for preliminary analysis. Pedigree of all animals with the exception of only 5 animals from BLRI (which had their pedigree known) was unknown mainly due to the absence of an animal recording system. The average body condition score of Indigenous buffaloes were 3.50 ±0.03(83), parity ranged from 1-7, horn length of 39.49±1.56(73) inches, birth weight of 35.03± 1.31(30) kg, black coat colored, heart girth of 180.78±0.92(73) inches, body length of 143.18± 0.60(73) inches, wither height of 92.73±2.20(73) inches, rump height of 104.64±1.34(73) inches, body weight of 428.26±10.10(47) kg, postpartum heat at 84.69±3.31(32) days, service per conception of 1.00±0.00(32), calving interval of 388.13±3.24(32) days, daily milk yield of 3.00± 0.06(101) kg, peak daily yield of 3.99±0.08(33) kg, fat content of 8.59±0.18(89)%, protein content of 3.83±0.06(89) % and SNF content of 9.50 ± 0.12(89) % were observed. The obtained results indicate that Indigenous buffaloes are good resource of Bangladesh and have scope for their improvement through breeding (based on the scale of variation in analysed traits).

SNP Analysis and gene expression profiling for milk fat and protein related traits in river buffalo populations of Bangladesh

The study was undertaken to investigate polymorphisms in several candidate genes and their association with milk fat and protein related traits in river buffalo of Bangladesh. Data were collected from 239 lactating animals from six different locations namely Madarganj, Jamalpur; Ishwardi, Pabna; Godagari, Rajshahi; Buffalo Breeding and Development Farm, Bagerhat; Milk Vita Buffalo Farm, Laxmipur and BLRI, Savar, Dhaka. Besides, a total of 242 blood samples were collected from the above regions. Genomic DNA extraction was performed using commercial kit. One or two fragments of three well annotated candidate genes (PPARGC1A, FASN and DGAT1) were selected for milk fat and protein related association studies. Accordingly, five primer pairs were used for PCR amplification and sequencing of the gene fragments. Multiple sequence analysis revealed 11 single nucleotide polymorphisms (SNPs) in the fragments of three candidate genes. Among them, two SNPs were identified in the FASN gene (g.7163G>A and g.7271C>T), two were in DGAT1 gene (g.7809C>T and g.8525C>T) and the remaining seven SNPs were in PPARGC1A gene (g.387642T>C, g.387714G>A, g.387758A>G, g.387966A>T, g.409354A>G, g.409452G>A and g.409614C>T). All identified SNPs were located in the exon regions except g.7163G>A SNP of FASN gene which is located in intron region. The frequencies of GG, GA and AA genotypes were 0.49, 0.46 and 0.06 for g.7163G>A SNP of FASN gene and the corresponding allele frequencies were 0.72

and 0.28 for G and A alleles, respectively. In case of g.7809C>T SNP of DGAT1 gene, the frequencies were 0.42, 0.42 and 0.17 for CC, CT and TT genotypes, and 0.62 and 0.38 for C and T alleles, respectively. The g.387758A>G SNP of PPARGC1A gene resulted 3 genotypes with frequencies 0.41 (AA), 0.52 (AG) and 0.07 (GG), respectively. Association analysis revealed that the g.7271C>T SNP of FASN gene had significant association with milk fat ($P<0.05$). The average milk fat of CC, CT and TT genotypes was 8.38±0.30, 7.92±0.37 and 9.64±0.71, respectively. The g.7809C>T SNP of DGAT1 gene was highly significant with SNF of the investigated buffalo milk samples ($P<0.01$) where the SNF% of CC, CT and TT genotypes were 9.73±0.20, 9.60±0.13 and 10.08±0.27, respectively. Moreover, three SNPs g.387758A>G, g.409354A>G and g.409614C>T of PPARGC1A gene had significant association with protein ($P<0.01$), protein ($P<0.001$) and SNF ($P<0.05$), and fat ($P<0.05$) and SNF ($P<0.05$) content of milk. The average protein content of AA, AG and GG genotypes of g.387758A>G SNP was 3.45±0.69, 3.40±0.62 and 4.07±1.82, respectively. It may be concluded that the identified significantly associated SNPs could be used as potential molecular marker(s) for improving milk composition traits in river buffaloes.

Standardization of estrus synchronization techniques for improvement of reproductive efficiency of native buffaloes in Bangladesh

The study was undertaken to improve the reproductive efficiencies of native buffaloes using the estrus synchronization technique. In experiment 1, a total of 32 buffalo cows of multiparous parity with a good body condition score (3.0–4.0) were selected at Madarganj Upazilla, Jamalpur for estrus synchronization to examine the effect of season on estrus synchronization in buffaloes. The estrus of buffaloes was synchronized with the Ovsynch protocol. Another 59 female native buffaloes were selected of the above region to examine the effect of mineral supplementation on the reproductive efficiencies of buffaloes. Among them 18 buffaloes were offered 10 gm of DCP plus and 20 buffaloes were examined as non-treated control group, and 21 buffaloes were selected for estrus synchronization with the ovsynch protocol. All buffaloes were offered 1 kg of concentrate feed mixture (60% maize crushed + 40% wheat bran) daily. Blood sample was collected one month after the treatment from the jugular vein for analysis of glucose, total protein, albumin, TG, cholesterol, ALT, ASP, and ALP to know the nutritional status of buffaloes. Result showed that all buffaloes showed estrus in breeding season, which was significantly higher than non-breeding season (86.67%). Again, 90.91% buffaloes conceived successfully in the breeding season, whereas 73.33% conceived in non-breeding season significantly. Glucose and total protein levels were ($P<0.05$) higher in the breeding season than in the non-breeding season. On the other hand, estrus was recorded in 83.33%, 91.67%, and 35% in mineral supplemented, GnRH treated, and non-treated buffaloes, respectively. Estrus was significantly higher in mineral supplemented and GnRH treated buffaloes

than the control group. Conception rates were significantly higher in mineral supplemented (70.83%) and GnRH treated buffaloes (83.33%) than the control group (30%). Calving rates were also significantly higher in the mineral supplemented group (65.83%) and estrus synchronized buffaloes (77.78%) than the control group (30% buffaloes). Glucose, albumin, TG, and cholesterol levels were significantly higher in the mineral supplemented and estrous-synchronized groups than the control group. It may be concluded that the reproductive efficiencies of estrus-synchronized native buffaloes were influenced by season, blood metabolites, mineral supplementation, and the time of insemination, followed by a second dose of GnRH treatment.

Increasing efficiency of artificial insemination for improving conception rate in river buffalo

The study was evaluated to find out the problems that affect the artificial insemination (AI) on conception rate in river buffalo and how to improve the conception rate using nutritional supplements at coastal areas. The study was conducted in the Bauphal upazila of Patuakhali and the Charfassion upazila of Bhola district. Data on buffalo breeds, health management, reproductive parameters, and management practices were collected by personal interviewing of 200 farmers (100 of each upazila) using pre-tested questionnaires. The results showed that 100% of farmers rearing buffaloes to generate income by selling milk and meat without supplementing any nutritious feed and feed supplements. For breeding purposes, they bred their buffalo cows through natural mating. Taking into account this survey, initially, we selected thirty (30) non-pregnant buffalo cows over 2 years of age from two upazilas. After selection, all the experimental buffaloes were marked by tagging. Nutritional variation might be a good factor in increasing the efficiency of AI. For the trial, selected buffaloes were vaccinated and dewormed and divided into four (04) treatment groups as T0= control; T1= supplemented with urea molasses straw; T2= supplemented with DCP and administrated AD3E; and T3= supplemented with T1 and T2. For the availability of green grass, 3 acres of land were cultivated for high yielding fodder production. Twenty-one (21) heated buffaloes were inseminated. Among them, 12 buffalo cows were assumed to have been conceived (not shown heat last 3 months). It may be concluded that the reproductive performance of dairy buffaloes was relatively poor. The overall scenario about the existing breeding management practices followed by the buffalo farmers was not satisfactory and this situation might definitely influence adversely on the productive and reproductive performance of animals. In this research, supplementing with various feeds and nutrition is an alternative to enhance the efficiency of AI as well as pregnancy establishment and overall reproductive performance of buffalo cows.

Optimizing the process technology of manufacturing value added diversified buffalo milk Cheese and Rasomalai based on their nutritional and physicochemical profile

The present study was designed to develop the suitable manufacturing technology/ SOP of fiber and healthy fat fortified value added buffalo milk rasomalai; monitor the shelf-life of diversified value added buffalo milk rasomalai and record the cost of production of different value added buffalo rasomalai. To achieve the objectives, rasomalai was prepared to add carrot and date at the rate of 0, 3, 6 and 9% and chia seeds at the rate of 0, 1, 2 and 3%. With the increased addition of carrot decrease in fat (10 to 7%), protein (14 to 13%) and total solids (49 to 40%) content of the rasomalai but increase the fiber content (0 to 5%). The addition of date reduced 4 and 7% fat and total solids, respectively and increased 2% fiber of the product. Fat, protein (2%) and total solids (7% more) content along with the fiber (2%) content were increased with the increased level of the chia seed. Result showed from the colour of the product that the increased level of added *chia* seed, the products become dark and there is a significant shift from green to red ($P<0.05$) but no variation was observed in case of blue to yellow axis of the color profile. The lightness of the product were also reduced with the increased addition of date but showed similar lightness in case of carrot added *rasomalai* ($P>0.05$). Addition of carrot caused a non-significant reduction in redness but significant increase in the yellowness of the product. However, date caused a significant increase in both the redness and yellowness of the prepared *rasomalai*.

Fig : Activities related with the fiber fortified *rasomalai* manufacturing and quality assessment

The addition of 3% carrot and 3% date separately in *rasomalai* resulted in significantly higher taste and flavor score (8.7 on 9.0) but *chia* addition did not cause any variation in this regard. All other attributes remained unaffected ($p>0.05$) in all three types (carrot, date and chia added) of *rasomalai*. In case of descriptive sensorial assessment, the 9% addition of carrot and date separately gave a significantly higher bitterness and date flavor, respectively. It may be concluded that 3% carrot and 3% dates and 2% *chia* seed in *rasomalai* preparation was found better.

Classical, applied, and molecular epidemiological studies to develop disease risk management, treatment, and control model of FMD, Anthrax, and HS in Buffaloes

The study was undertaken to generate real-world data on the transmission and dynamics of diseases, particularly FMD, Anthrax, and HS, in buffalo populations within specific study areas. Initially, a field survey to assess the frequency of diseases and farmers' perceptions of Foot and Mouth Disease (FMD), Anthrax, and Hemorrhagic Septicemia (HS) in buffaloes. To ensure adequate statistical power for analysis a total of 600 buffalo farmers, 200 farmers from each of the three conveniently selected upazilas of Fenchuganj, Companiganj, and Godagari. To reduce the cost of laboratory testing, explored various pooling strategies by reviewing literature. Based on responses from farmers in survey, the most prevalent diseases in the study area are HS, Lumpy Skin Disease (LSD), FMD, Anthrax, and nonspecific diarrhea. According to the survey results, 35% of farmers identified HS as the primary buffalo disease, followed by 28% LSD, 26% indicating FMD, 8% designating Anthrax, and 3% considered diarrhea as a significant health problem. Concerning the significance of livestock disease categories, farmers prioritized the diseases in the following order: infectious diseases, internal parasites, external parasites, nutrition, and toxicity. Regarding constraints in disease control, farmers identified the following issues in order of importance: a lack of information for farmers, insufficient training for farmers, a shortage of expert assistance, and a deficiency in disease alert and vaccination services. Results of the simulation pooling strategies demonstrate that a larger pool size maximizes pooling efficiency at low prevalence, whereas a smaller pool size maximizes efficiency at higher prevalence. None of the pooling schemes can improve efficiency at prevalence's above 30%. A pooling efficiency of 70% or higher was obtained by the intermediary pool sizes (8,10,12) at a prevalence level of 2%. The same level of efficiency was gained with a larger pool size (15,18,20) at a prevalence level of 1%. The simulation results elucidate the intricate relationship between pool size and pooling efficiency in various prevalence levels. It may be concluded that diseases identified especially HS, LSD and FMD demand targeted interventions and intensified surveillance.

Exploring a model for the buffalo calf health management through improved therapeutics against pneumonia and diarrheal diseases in selected

Subtitle : Characteristics and performance of micro-enterprises in the buffalo production sector: A survey in coastal regions of Bangladesh

Buffaloes are raised under an extensive system in the coastal and hilly areas where large-scale pasture land and enough green forage are available. One of the most important characteristics of buffalo production in Bangladesh is that they are raised by medium or large farmers who are generally considered rich in the locality. Therefore, considering all the geo-climatic features and the new prospect of buffalo farming at the coastal region, the challenges of buffalo health management, farmers must need to play an integral role in minimizing disease threats and managing ongoing conditions on their farms. The study was conducted using a structured questionnaire in designated clusters located at in Bhola, Barishal, Patuakhali and Noakhali. The qualitative study, especially field interview method was followed to get the information from buffalo producers as micro-entrepreneurs (MEs) in study areas. A structured questionnaire was used to perform individual in-depth interview through focus group discussion. Characteristics of micro-entrepreneurs (MEs) included a total of 64% MEs were males and 36% were females. The average age of the respondent MEs was 45.75±1.01 years. The educational qualification of owners indicates that the majority of MEs (50.49%) had completed primary school. Various training courses were attended by MEs of this study. About 46.53% of MEs received training on livestock's health and vaccination, and 28.71% received technical training on entrepreneurship and business management. But 16.83% had not received any training before starting their business. The average household of MEs was 5.84±0.17. The average income of MEs was BDT 22480.00±1350.00 with a range from BDT 1200.00 to 70000.00. Average 56.96% of MEs showed herd health management skill and 16.50% of MEs expressed knowledge on business management and marketing. A large percentage of MEs were able to recognize a healthy and a sick animal (97.09%), properly store vaccines and other medicines (73.79%, ($P<0.05$), to detect common buffalo diseases and udder problems (65.05%, ($P<0.05$)) and to detect heat (estrus) in buffalo cows and understand the basics of AI (63.11%). Screening MEs' skills on herd health management reveal that a few MEs could design, initiate and maintain a herd health program (25.24%) and set an effective culling standard (17.48%, ($P<0.05$). Therefore, these results suggest that more training on-farm and enterprise's management in term of herd health, business, marketing and entrepreneurship, should be conducted to improve MEs knowledge.

Development of chitosan-graphene-based nanobiosensor for curving buffalo mortality through early-stage detection of haemorrhagic septicaemia

The research was aimed to (i) Fabrication of thin layer graphene transferred chitosan-based Nano biosensor; (II) Isolation identification and molecular characterization of *P. multocida* from the field samples; (iii) Characterization of electrochemical signal from *P. multocida* and their analytes using nanobiosensor and (iv) Evaluation of sensing performance of nanobiosensor from clinical specimens. A thin layer chitosan membrane was prepared with the cast printing method while its aqueous stability was achieved through Glutaraldehyde and graphene oxide cross-linking (Fig. 1a). The fabricated chitosan membrane was functionalized using Glycine and Silver nanoparticles for enhancing surface-analytes interactions (Fig. 1e). For optimizing the sensitivity, different ration of Chitosan-Graphene Oxide (Chit-GO) composite (3:1, 6:1, 9:1,12:1, and 15:1) were drop casted during the fabrication of cross-linked membrane (Fig. 1b). The fabricated membrane was characterized by UV-vis spectroscopy and Scanning Electron Microscopy (SEM) for realizing the surface topography (Fig 1c).

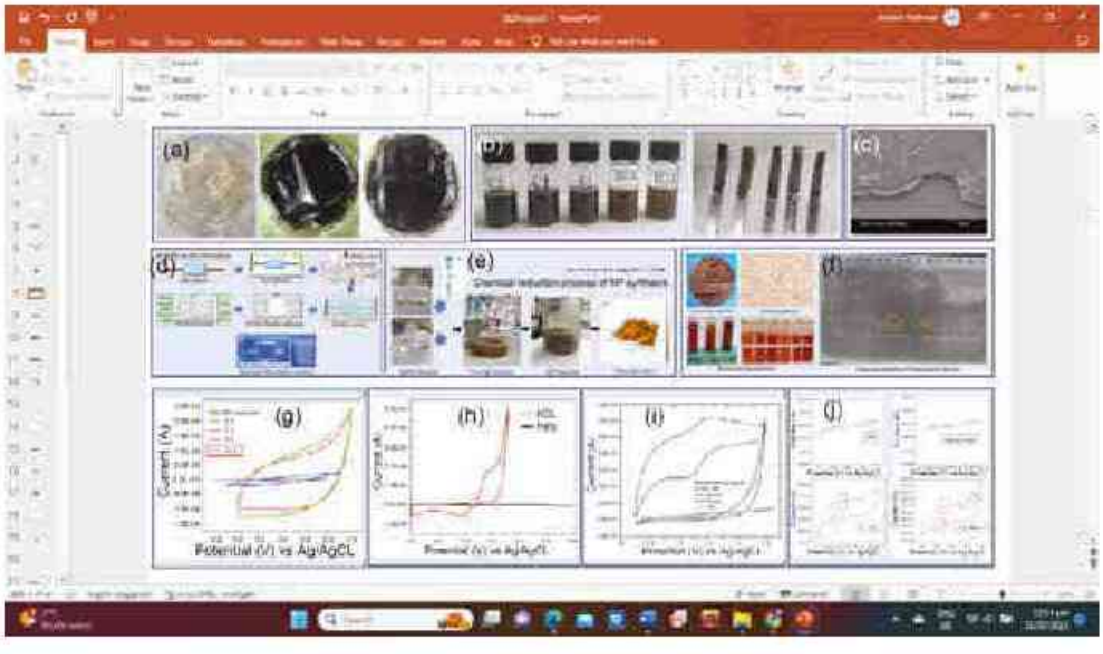

Fig : Overall activities for the development of nano biosenso The Chit-GO composite was prepared for electrochemical detection of *Pasturella multocida* using the gap-electrode integrated with the developed microfluidic chamber (Fig. 1d). For that, the two *Pasturella multocida* isolates was isolated from 40 nasal swabs of buffalo calves collected from Madarganj at Jamalpur In Mymensingh (Fig 1f). The physical and electrochemical characterization of Chit-GO electrode revealed that the peak current of PBS (Fig. 1g) and KCL (Fig1h) decreased with the increase of the Chit-GO

composite ratio (3:1, 6:1, 9:1, and 15:1) while that was stable when 12:1 Chit-GO was applied. Thus, the 12:1 Chit-GO composite was selected for electrochemical detection of known *E. coli*. The Cyclic Voltammetry (CV) and Linear Swipe Voltammetry (LSV) results revealed that the redox peak potential of the bacteria was found at 0.1V while the oxidation peak potential was at -0.2V. Whereas, the redox current peak was maximum (2.5×10^{-4}) and oxidation peak was (-3.5×10^{-4}) for bacteria. Whereas, such potential peak was absent for PBS. Such signal acquisition was further verified with the electrochemical detection of Vero cell. The Vero cell signal revealed that, the redox peak potential was found at 0.1V, while the oxidation peak potential was at -0.1V which is completely different from the *E. coli* peaks (Fig 1I and 1J). The intensity of the redox current peak was maximum (1×10^{-6}) and oxidase was (-2.5×10^{-6}) for Vero cell. Whereas such peak intensity was absent for PBS. Thus, the analytes specific signal acquisition was confirmed using the developed chit GO sensor. Therefore, it is confident in detecting *P. multocida* using the developed sensor. Meanwhile, the Non-haemolytic mucoid colonies of 1-3mm in diameter, Gram-Negative, Small rod or coccoid rods in pairs, Ring formation in Indole test, and the amplified band at 460 bp of the primer KMT1T7 and KMT1SP6 for PCR confirmation of *P. multocida*. the species-specific primers. This culturally, biochemically and molecularly confirmed *P. multocida* are under electrochemical characterisations using this shift in peak potential. The *P. multocida* specific electrochemical signal will be employed for the detection of HS from buffalos in the future.

Unlocking the microbial diversity in artisanal 'Buffalo Milk Curd' to formulate probiotic based bio-functional starter culture towards developing healthy Dahi

The study was designed to disclose the microbial communities present in this artisanal product and also to formulate a probiotic based value-added dahi through microbial diversity analysis as well as isolation and identification of probiotic potent bacteria. Samples of 'Buffalo Milk Curd' were collected from Char Fasson (n=6) and Companiganj (n=4) Upazila of Bhola and Noakhali districts, respectively during the pre-monsoon season. Soon after the preparation, the curd and corresponding milk samples were transported to the laboratory. For metagenomic analysis, the DNA was extracted, pooled and analyzed for enumerating mesophilic group, count viable cells of each group bacteria, molecular identification of pure isolates and identification of strains for three different types of in vitro probiotic potential. Additionally, the whole genome sequencing of three promising strains was carried out. The results showed that both aerobic (at 10.9 log cfu/g) and anaerobic (at 11.0 log cfu/g) mesophilic bacteria, as well as aerobic (at 11.2 log cfu/g) and anaerobic (at 11.1 log cfu/g) lactobacilli were dominated by a different category of bacteria. Furthermore, another dominant group of bacteria prevalent in the curd samples was total anaerobic count,

which measured at 11.2 log cfu/g. *Enterobacteria* and *coliforms* were found at 5.8 log cfu/g and 4.4 log cfu/g, respectively. Additionally, the viable cell numbers of *lactococci* and *leuconostocs* were recorded at 6.3 log cfu/g and 7.9 log cfu/g, respectively. On the other hands, a total of 85 pure isolates from different bacterial groups whereas 35 from presumptive *leuconostocs* group and 20 from *lactobacilli* group were identified. The isolates constituting 77.14% were identified as *Leuconostoc citreum*, 5.71%, belonged to the species *Leuconostoc holzapfelii* and 17.14% of the leuconostocs group as *Leuconostoc mesenteroides*. Ten randomly selected *Leuconostoc* strains and ten *Limosilactobacillus* strains were tested and all the tested *Leuconostoc* strains exhibited varying degrees of inhibition against *Salmonella* sp., resulting in inhibitory zone diameters ranging from 8 to 15 mm. Similarly, the growth inhibition of *Salmonella* sp. displayed isolate-dependent variability, spanning from 18.2 to 55.6%. In contrast to the *Leuconostoc* strains, the *Limosilactobacillus* strains displayed a notable inhibitory zone, with the highest inhibitory zone of 20 mm. It may be concluded that the curd harbored diverse beneficial bacteria, including *Leuconostoc* and *Limosilactobacillus* strains. The strains exhibited varying levels of probiotic potential as well as bioactive properties.

Other project activities

- Purchased indigenous buffalo
- Purchased farm and laboratory equipment
- Construction of buffalo shed at BLRI savar, Dhaka.

Fig : Purchased indigenous buffalo





Fig : **Construction of buffalo shed at BLRI Savar, Dhaka**

Zoonoses and Transboundary Animal Diseases Prevention and Control Research Project

Development of Avian influenza H9N2 vaccine from circulating strain

Avian influenza virus (AIV) subtype H9N2 is the most widespread AIV in poultry worldwide, causing great economic losses in the global poultry industry. Vaccines are considered an effective strategy for fighting H9N2 infection. The development of inactivated AIV H9N2 vaccine seed from circulating strain was the main objective. A total of 337 poultry samples were collected from different geographical locations in which 13.05% (n=44) of samples were found positive for A/H9N2 virus. Positive A/H9N2 samples were cultured into 9-11 days old SPF embryonated chicken eggs. Confirmation of growth of virus was performed by HA test and rRT-PCR with specific primers. Total of 16 cultured samples were found positive with only A/H9N2 virus in which 10 isolates were sub-cultured up to 10 passages into 9-11 days old SPF embryonated chicken eggs and found with average $\log2^8$ HA value and confirmed A/H9N2 isolates were tested for EID_{50}, and found $10^{7.83}EID_{50}$/ml. Any bacterial contamination was not observed in A/H9N2 cultured isolates. The inactivation with formaldehyde was confirmed by prolonged passages in embryonated SPF chicken egg. The 4 weeks old A/H9N2 sero-negative Sonali birds were treated with different dose of inactivated A/H9N2 vaccine. The results showed that the inactivated H9N2 vaccine elicited significant haemagglutination inhibition (HI) antibodies in chickens. The vaccinated group of BLRI developed A/H9N2 vaccine showed rapid increases of antibody against A/H9N2 following vaccination. In in-house trials, the peak HI titre in chickens was around 11 log2 at 4 weeks after immunization and the HI titres in chickens were still higher than 6 log2 at 16 weeks of post-immunization. In conclusion, it was found that the BLRI developed inactivated A/H9N2 vaccine elicited significant H9N2 specific antibodies in chickens, and immunized chickens exhibited a longer duration of antibody presence, suggesting that this vaccine was effective and safe.

Development of lumpy skin disease vaccine seed from circulating strain in Bangladesh

The project is undertaken with the objectives of molecular characterization of the circulating LSDV in Bangladesh and development of live attenuated vaccine seed from the circulating strain. From August, 2021 to June, 2023, a total of 165 clinically suspected LSDV samples cases were collected from 21 different field outbreaks areas of 20 districts in Bangladesh. LSD viruses were identified by PCR and isolated in primary

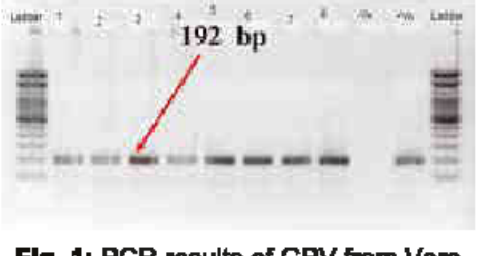

Fig. 1: PCR results of GPV from Vero cell at 52nd Passage

LTC. Out of 165 sample cases, 93 (56.36%) cases were found PCR positive and the expected PCR amplicon size was 192 bp. In total, 10 LSDVs were successfully isolated from different field outbreaks in Bangladesh. After isolation, adaptation and attenuation of LSDV were done in multiple cell lines (Vero and MDBK) cell line. LSDVs were quantified by Plaque Assay and $TCID_{50}$. The values of Plaque forming Unit (PFU)/ml and TCID50 of LSDV vaccine seed at 60th passage were very similar. Sterility and purity test of developed live attenuated LSD vaccine were done followed by vaccine safety, efficacy and potency test in xenogeneic animals (mice) and experimental calves as per WOAH guideline. The efficacy test of developed LSD vaccine in calves was performed by Indirect ELISA. In Indirect ELISA, mean antibody titers (S/P %) of single dosages of LSD vaccine in calves were 98.11 ± 6.83, 177.86 ± 23.61 and 269.09 ± 54.23 on 7, 14 and 21-days post vaccination respectively where as in 10 times dosages calf did not show any adverse effects with the exception of fever. The efficacy tests were also performed by virus neutralization test (VNT). In addition, whole genome sequencing of LSDV was performed, and analysis is underway. Validation trial of LSD vaccine by DLS is going on.

Fig.: A. Confluent MDBK cell line; B, C, D, E showing CPE at 1, 2, 3, 4dpi respectively (4x) at

Fig: Safety trial of BLRI LSD vaccine seed

Fig: In house trial of BLRI LSD Vaccine seed

Fig: Validation trial of BLRI LSD Vaccine seed at Dairy farm by stakeholder

Development of Goat pox vaccine seed from circulating local strain

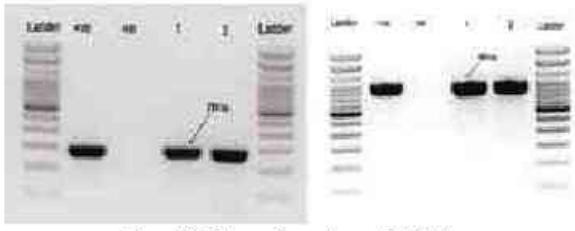

Fig : PCR confirmation of GPV

The present study was undertaken to detect, isolate and characterize the circulating field strains of goat pox virus (GPV) and the development of live attenuated GP vaccine seed. A total of 121 clinically suspected GP sample cases were collected aseptically from Meherpur, Jhenaidah, Chuadanga, Dinajpur, Rangamati, Naogaon, Bagherhat, Chapai Nawabganj, Cox'sbazar, and Sylhet districts. After collection, the samples were labeled and immediately transported to the vaccine and biologics laboratory, BLRI in an ice-cool container. Subsequently, the genomic DNA was extracted by DNA extraction kit and confirmed by PCR. Inoculum were prepared from fresh PCR positive samples, and inoculated into primary LTC for the isolation of GPV. Out of 121 sample cases, 76 (62.82%) sample cases were found PCR positive. The expected PCR amplicon size was 289 bp and 969. Till now, 8 GPV successfully isolated from the field samples. Adaptation and attenuation of GPV isolates in vero/MDBK cell line is going on for the development of live attenuated GP vaccine seed and currently 52th passage has completed. After each passage, CPE produced by GPV in the cell line were reconfirmed by PCR and harvested and stored at -800C. Partial gene sequencing of representative 4 GPV from 4 outbreak areas was done and it revealed that our identified GPV are identical to each other and may have a common ancestral relationship with Indian isolates. For the quantification of GPV, TCID50 were conducted in every 5th passage of GPV attenuation.

Fig.2 (A) Confluent vero cell line, (B) CPE at 50th passage at 4 dpi (4x), (C) CPE at 52th passage at 4 dpi (10x)

Fig.3: (A) Confluent MDBK cell line, (B) CPE of 50th passage at 4 dpi (4x), (C) CPE of 50th passage at 4 dpi (10x)

Development of *Salmonella* vaccines from circulating strains of poultry in Bangladesh

Non-typhoidal Salmonella are widely distributed throughout the world, especially in developing countries. Salmonella enterica are predominantly being abundant in Bangladesh. As a common cause of mortality and/or decreased productivity among poultry population, it necessitates in-depth investigation and prophylactic action against Salmonella. Thus, the research was conducted to develop an inactivated salmonella vaccine from circulating Salmonella Enteritidis and Salmonella Typhimurium strains. Salmonella spp suspected clinical samples (liver and intestine) were collected from different layer farms and private veterinary hospitals of Dhaka, Manikganj, Narsingdhi, Tangail, Gazipur, Chattogram and Bogura districts during July 2022 to June 2023. Samples were transferred to the Animal Health Research Division immediately after collection. Samples were processed for bacterial isolation, identification and molecular identification to confirm Salmonella at genus level and later on at species level. For the PCR, DNA was extracted from the isolated samples using boiling method. Salmonella spp., S. Typhimurium and S. Enteritidis was confirmed by targeting the sdiA, Typh and sdf-1 gene, respectively. Among the 350 samples, *Salmonella* spp was isolated and identified from 34 samples (34/350, 9.7%) and confirmed by PCR at genus level. After detection of *Salmonella* at genus level, PCR was carried out to confirm *S.* Enteritidis and *S.* Typhimurium of the 34 PCR positive samples. Out of 34 *Salmonella* isolates, 3 for *S.* Enteritidis and 10 for *S.* Typhimurium were confirmed by PCR with species specific primers (Figure 1). The isolated *S.* Enteritidis and *S.* Enteritidis were characterized by Whole genome sequencing (WGS). Now the isolates will be inactivated with Binary Ethylene Imine (BEI) and mixed with adjuvant in appropriate ratio. The efficacy and safety test of developed *Salmonella* vaccine will be performed.

Fig. 1: PCR result of representative Salmonella spp (284bp) S. Enteritidis (293bp) and S. Typhimurium (401bp) isolates

Phenotypic and genotypic profiling of antimicrobial resistance (AMR) in enteric bacterial communities in finisher livestock and poultry in Bangladesh

Antimicrobial resistance (AMR) is a worldwide global health problem. AMR in Bangladesh's livestock and poultry food value chain is becoming a bigger worry. The objectives of this study were to assess spatio-temporal variation along with flock-to-flock variation in AMR phenotypes and associated antimicrobial resistance genes (ARGs)

In fecal commensal enteric bacteria in poultry farm and live bird markets (LBMs). A total of 567 samples were obtained from various locations in the districts of Gazipur, Narsinghdi, Bogura, Joypurhat, Barishal, Sylhet, Chattogram, Cox's Bazar, and Jessore. The samples included 81 cloacal swabs, 81 drinking waters from various poultry farms, and 27 caecal contents from LBMs. Next two successive years, samples will be collected from same geographical location to determine the spatio-temporal patterns of AMR. The overall recovery rate of *E. coli* and *Salmonella* was 76% and 8%, respectively. AST was done by disk diffusion method for all *E. coli* and *Salmonella* isolates. From the AST results, we found that tetracycline (89.3%), ampicillin (86.2%), ciprofloxacin (69.7%), nalidixic acid (72%), and sulphamethoxazole (66.1%) were the most resistance antibiotics in *E. coli* whereas almost same resistance patterns were observed in *Salmonella* isolates. For spatio-analysis of AMR in *E. coli* isolates, it dictated that tetracycline was the highest resistance in five sampling areas followed by ampicillin, nalidixic acid and ciprofloxacin. In case of *Salmonella*, ampicillin was the highest resistance almost in all sampling area followed by tetracycline, nalidixic acid and ciprofloxacin. A total of four ARGs were detected by PCR in both phenotypically resistant isolates whereas *bla*TEM (89%, 82%), *tet*A (91%, 81%), *sul*1 (96%, 92%), and *sul*2 (36%, 31%) were detected in *E. coli* followed by *Salmonella* isolates. The results showed that resistant *Salmonella* and *E. coli* are circulating in live bird markets and poultry farms, which can quickly spread to the food chain.

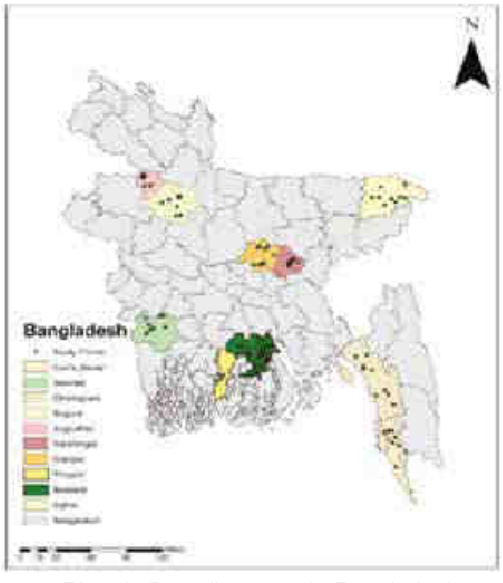

Fig : 1. Sampling area in Bangladesh

Development of multivalent (*Eimeria tenella, E. necatrix, E. brunetti, E. maxima*) coccidial vaccine for poultry.

Coccidiosis, a disease caused by protozoan parasites, *Eimeria* species which can affect all livestock and poultry species. This disease has been imposing profound effects on production and welfare of livestock especially in poultry. Furthermore the objectives in the financial year 202-23 were isolation, identification, and molecular characterization of different Eimeria spp. of chicken in Bangladesh and development of multivalent coccidial vaccine candidate from Eimeria spp in chicken. A total 77 suspected clinical samples were collected randomly on questionnaire basis from commercial poultry farms located in Dhaka (Savar, Ashulia), Dhaka and Rajshahi, Jessore, Faridpur (Bhanga). PCR reaction was standardized with pure DNA of all

seven species of *Eimeria* targeting ITS-1 based primer sequence of *E. brunetti* (310 bp), *E. maxima* (205 bp), *E. mitis* (306 bp), *E. necatrix* (285bp), *E. tenella* 271 bp. and E. acervulina (321 bp). It was found that *E. tenella* (23%, P<0.05), *E. brunetti* (24%, P<0.005), *E. necatrix* (27%. P<0.4), *E. mitis* (18%, P<0.06), *E. maxima* (19%, P<0.006), and E. acervulina (4%, P<0.002), were prevalent among seven species. In this study, it was found that 76.62 % (n = 59/77) of the samples were positive for *Eimeria* spp. based on microscopic analysis. However, blood profile and histopathology was done of 5 infected and non-infected each, poultry bird comparison and evaluation of poultry health. A total 5 Isolates of *Eimeria spp. (E. tenella, E. necatrix, E. brunetti , E. maxima) has been prepared and going forward for attenuation in the CAM route in 9 days ECG. However, the average EPG is 2000-2500* oocyst/ml. Finally, it was observed that due to adding high level of coccidiostat in commercial poultry feed it is sometime difficult to collect typical outbreak samples of coccidiosis and availability of coccidiosis in poultry is less in summer season.

Training program: Under the aforementioned project one officer's and five farmer's training course have been conducted according to the training calendar of the respective FY.

Officer's Training: To serve the project mandate, project office arranged the residential training program on 2-3 October 2023 participating with 10 Upazila Livestock Officer as well as in-charge of 10 different quarantine stations. Through that training participants were trained to detect zoonosis and transboundary animal Diseases.

Fig : Officer's training held on 2-3rd October 2022

Fig : **Farmer's training program**

Farmer's training: The project office postulated a training module named "Training on Biosecurity and Management of Zoonotic and Transboundary Animal Diseases in Modern Cattle Farms" and conducted five different training programs on it at BLRI HQ, Joshore, and Godagari regional stations, Teknaf and Sharsha upazila, with 50 farmers in each batch.

Capacity building: To strengthen the laboratory capacity, project office procured various types of laboratory equipment such as Cell sorter machine with Flow-cytometer, MALDI TOF Biotyper, Western blot system, Gel documentation system, Automated Nucleic Acid Extractor etc. during the last fiscal year.

Fig : **Laboratory equipment**

Dairy Research and Training Centre

Assessment of environmental stresses on different genetic groups of dairy cattle and development of their mitigation strategies

Dairy farming is significantly impacted by environmental stress and the most important tool for determining the level of environmental stress is the Temperature-Humidity Index (THI). Therefore, the present study was undertaken to measure the cyclic environmental stresses through THI on different blood percentages of Holstein Friesian (HF) dairy cows and their effect milk yield and composition, physiological responses and biochemical blood properties. The research was carried out using Holstein Friesian crossbred dairy cows in Central Cattle Breeding Station and Dairy Farm, Savar, Dhaka. A total of 25 dairy cows with 5 genotypes (Local, 50% HF, 62.5% HF, 75% HF and 87.5% HF) and 5 from each genotypes were considered. To record the temperature and relative humidity 4 Digital thermo Hygrometer were hanged in 4 corner of the shed at the animal height and data were recorded 3 times in a day (6 am; 2 pm and 10 pm). Temperature humidity index (THI) was calculated by using the following equation: THI= [1.8×T+32]-[0.55-0.0055×RH] × [1.8×T-26] (Gantner et al. 2010). THI≤68 were considered as comfort, 69≤THI≥74 were considered as thermo-neutral and THI≥75 were considered as stressed condition. In results, average THI from December to February was found within comfort range (THI≤68), March to May was in thermo-neutral range (69≤THI≥74) and June to September was in stress condition (THI≥75). Highest THI=89.81 was found in 10 June, 2023 and lowest THI=61.91 was found in 17 January, 2023. The results of this study revealed that, cows with higher percentages of Holstein genetics (HF 87.5%) exhibited a significant elevation (P<0.01) in rectal temperature (102.58^{0}C), pulse rate (67.02 beats/min), and respiration rate (36.07 breaths/min) compared to cows with lower Holstein Friesian blood percentages (62.5% HF, 75% HF). The study also demonstrated a significant decrease (P<0.05) in milk yield and milk composition in response to heat stress on different blood level of HF dairy cow. It was found that, cows with higher HF blood (HF 87.5%) percentages exhibited 31% decrease in milk yield, 27% decrease in fat content, 7.78% decrease in protein content, 5.71% decrease in SNF and 5.21% decrease in lactose content. The study also revealed a significant alterations (P<0.05) in the biochemical blood profiles of different blood percentage HF dairy cows subjected to heat stress and variations were observed in glucose, total protein, uric acid, cholesterol, calcium, HDL, SGPT and SGOT levels. In conclusion, this study revealed a strong relationship between THI, cow physiology, biochemical blood properties, productivity and overall cow performance. According to this study, HF cows with higher blood percentages are less resilient to stress than those with lower blood percentages.

Fig : Lab & on farm activities

Isolation, identification, and molecular characterization of lactic acid bacteria from traditional dahi

The study aimed to identify probiotic lactic acid bacteria (LABs) from fermented Dahi in Bangladesh after studying the physico-chemical and microbiological attributes. Twenty samples were obtained from four locations and tested for pH, acidity, moisture, total solids, fat, protein, sugar, and ash content. To isolate and identify LAB, the MRS agar media were used for growing bacterial colonies by incubating at 37°C for 24 h. Physiological, morphometric, and biochemical analysis were used to identify colonies, and then MALDI-TOF MS and PCR-assisted amplified 16S rRNA gene sequencing (sangers sequencing) were used to characterize *Lactobacillus spp.* The results demonstrated that the proximate composition of dahi were found in normal in four locations which were significantly varied among the locations studied. The total yeast count and TVC were significantly varied ($P < 0.01$) in four locations and ranged from 0.19×10^4 to 0.38×10^4 cfu/g and from 23×10^4 to 38×10^4 cfu/g, respectively. Out of 23 isolates, 13 were confirmed as *Lactobacillus spp.*, while 10 were coccus. Most isolates were sensitive, with only 3 being resistant to maximum antibiotics tested. The MALDI-TOF MS test identified four distinct LABs: *Lactobacillus casei*, *Lactobacillus paracasei*, *Lacticaseibacillus rhamnosus*, and *Limosilactobacillus fermentum*. Molecular homological analysis by BLAST analysis confirmed the isolates. The phylogenetic tree was constructed based on 16S rDNA sequences, with isolates DRTC 2 and DRTC 8 most closely related to *Limosilactobacillus fermentum*. Isolates DRTC 18, DRTC 13, and DRTC 14 were most closely related to *Lactobacillus casei, Lactobacillus paracasei, and Lacticaseibacillus rhamnosus*. In conclusion, the isolated colonies from the Dahi samples were identified as four distinct LABs of *Lactobacillus casei, Lactobacillus paracasei, Lacticaseibacillus rhamnosus,* and *Limosilactobacillus fermentum* based on their morphological, biochemical, and molecular identification. The isolation and identification of probiotic LABs will continue until targeted isolates are characterized.

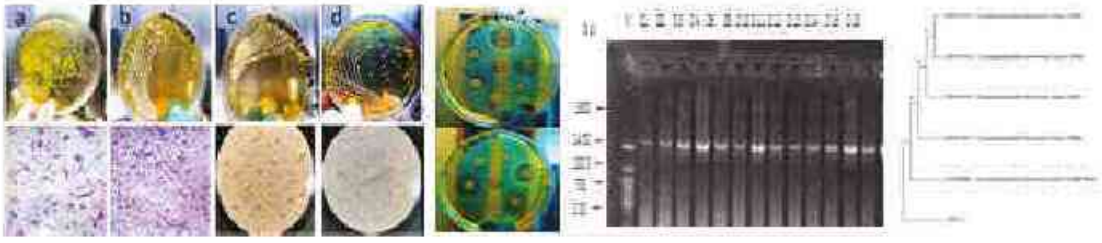

Fig. : The physiological and morphometric identification following the PCR of housekeeping primers, and the phylogenetic tree was constructed by MEGA 11 software of the isolates.

Production of beta-cyclodextrin for the development of low cholesterol milk and milk products

Sub-title: Effect of different levels of beta-cyclodextrin on the composition and cholesterol contents of milk

Beta-cyclodextrin (β-CD), a cyclic oligosaccharide, non-toxic and completely metabolized by the colon microflora, can easily absorb cholesterol from liquid mixture at temperatures 4-8°C. The present study was undertaken to evaluate the effect of different inclusion level of β-CDs on the separation of cholesterol from milk. To fulfil the objective a total of four activities were conducted including separation of cholesterol from milk using β-CD, development the method for the determination of cholesterol contents in milk, determination of milk composition before and after treatment with β-CD and isolation of Bacillus *sp.* producing bacteria from soil. In activity-1, a total of 45 milk samples (raw, pasteurized, pasteurized and homogenized milk) were collected and treated with β-CD at 4 inclusion levels (0.5,1.0,1.5 and 2.0% of β-CD) using five replications for each. In activity-2, cholesterol content of milk was determined both before and after treatment with β-CD by using spectrophotometer. In spectrophotometer, calibration curve was made with five standard concentrations (2, 10, 20, 40 and 70 ppm). In activity-3, nutrient composition of milk was measured with the help of Funky Gerber and Lactoscan machine. In activity-4, a total of 9 soil samples were collected. Pure microbial colonies were separated through repeated and successive screening of colonies by using Luria Bertani agar media. The isolates were examined for their colony and cell morphology, motility and standard biochemical tests. In activity-1, the cholesterol contents were reduced up to 38.44-73.09% in raw milk, 39.4-75.91% in pasteurized milk, and 41.97- 79.42% in homogenized milk sample at the inclusion level of beta cyclodextrin treatment (Figure 1). During cholesterol analysis in spectrophotometer, maximus absorbance (λ_{max}) was found at 420 nm. Correlation coefficient (r) of absorbance and standard concentration was 0.998 for the calibration curve. In β-CD treated milk, fat, SNF, protein, lactose &

mineral contents were found almost similar to the untreated milk (Table 1), while only TS content was found statistically higher than the later one ($p<0.05$). The higher total solid contents in β-CD treated milk might be due to the hydrophobic nature of β-CD. However, no change was observed in color, flavor, taste and smell of β-CD treated milk compared to that of untreated milk. In activity-4, a total seven (7) colonies were isolated as *Bacillus sp*. based on their morphology and biochemical tests but for further confirmation isolates are being analyzed for 16S rRNA gene sequencing. The study concluded that cholesterol contents of milk were precipitated by using β-CD and the highest efficiency of cholesterol reduction from milk was found at of 2% (w/v) inclusion of β-CD.

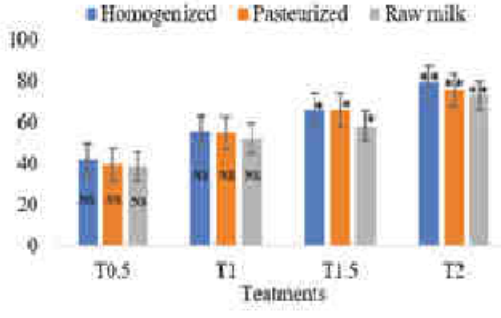

Fig. : *=significant at 5%, **=significant at 1%

Parameters	Concentration (mg/L)					SEM	P value
	T_0	$T_{0.5}$	$T_{1.0}$	$T_{1.5}$	$T_{2.0}$		
Fat (%)	4.31	4.32	4.35	4.34	4.34	0.009	0.06
Solids not fat (%)	8.05	8.08	8.12	8.13	8.18	0.036	0.19
TS (%)	12.36^{b}	12.40^{b}	12.47^{ab}	12.47^{ab}	12.52^{a}	0.030	0.03
Protein (%)	2.76	2.80	2.79	2.81	2.79	0.021	0.47
Lactose (%)	4.73	4.71	4.72	4.74	4.72	0.026	0.93
Salt (%)	0.65	0.63	0.63	0.663	0.63	0.010	0.56

Table 1

Quality and safety assessments of milk and the development of fortifying dairy products

Sub-title: Detection of heavy metals and antibiotic residues in raw milk collected from different locations

The present study was conducted to determine the concentration of heavy metals in cows' raw milk as well as in related sources and to measure the level of antibiotic residue in milk. For heavy metal detection, a total of 270 samples (54 milk, 54 feed, 54 fodder, 54 water, and 54 soil samples) were collected from the industrial areas of Savar, Chittagong, and Cumilla and the non-industrial areas of Sirajganj, Jessore, and Rangpur. Parameters observed were lead (Pb), cadmium (Cd), and chromium (Cr). The samples were analyzed using flame atomic absorption spectroscopy. On the other hand, for antibiotic residue detection, four commonly used antibiotics (amoxicillin, gentamicin, ceftriaxone, and oxytetracycline) were considered. The total number of treated and control cows was 16 and 4, respectively. The samples were analyzed using liquid chromatography-tandem mass spectrophotometers (LCMS-

MS). All the data were analyzed using SPSS version 25. The result showed that the concentrations of Pb, Cd and Cr in milk differed significantly ($p \leq 0.001$) among the six locations. The concentrations of Pb and Cd were within the MRL limits. Whereas, the concentration of Cr exceeded the MRL in both industrial (0.2199 ppm) and non-industrial (0.2520 ppm) areas. The study also determined the concentrations of Cr in concentrate feed, fodder, water and soil samples that ranged from 0.0583 to 0.3113 ppm; 0.0600 to 0.2653 ppm; 0.1990 to 0.2287 ppm and 0.0520 to 0.1333 ppm respectively. The method for the determination of the residue of amoxicillin antibiotic in milk has been developed using LCMS-MS and the recovery was 97.5%. The residue of amoxicillin was not found in the milk samples. The results of this study revealed that the concentration of Cr in milk exceeded the maximum limit in both the industrial and non-industrial samples. The residue of amoxicillin was not found in the analyzed milk samples. Further studies are necessary to develop methods for gentamicin, oxytetracycline, and ceftriaxone antibiotics to determine their residues in milk.

Fig 1: Detection of heavy metal using FAAS

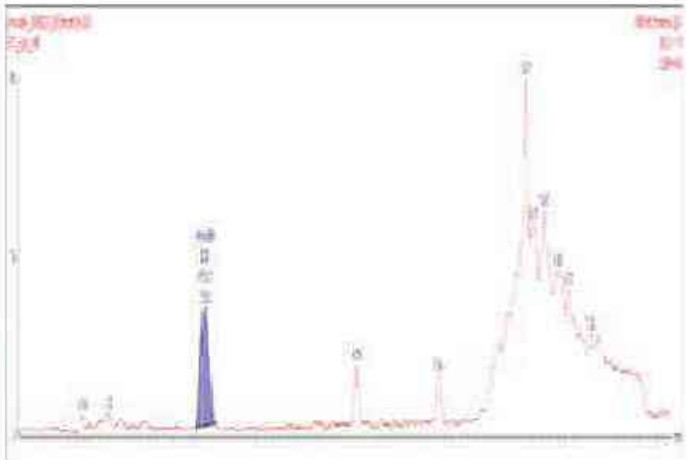

Fig 2. Chromatograph of amoxicillin residue detection

Regional Station, Baghabari, Sirajgonj

Evaluation of production performance and nutrient components of different fodder varieties and development of fodder germplasm bank at BLRI RS Rajshahi

Availability and quality of green grasses are major constraints of cattle production in Bangladesh. In addition, fodder cultivation in Barendra region is a great challenge because of its high environmental temperature and lower rainfall condition. Farmers are not conscious about livestock feeding with green fodder and usually use the byproducts of paddy as livestock feed that remains in the field after harvesting. Bangladesh Livestock Research Institute (BLRI), regional station (RS), Rajshahi is the second largest regional station having about 26 acres of land among five RS's of BLRI. A replica of Red Chittagong cattle (RCC), Buffalo, Black Bengal Goat (BBG), three types of native chicken have already established at RS, Rajshahi. A replica of fodder germplasm like BLRI head quarter containing all economically important fodder varieties is immediately needed to establish at BLRI, RS, Godagari, Rajshahi. Then, evaluation of those conserved fodder varieties for selecting a suitable fodder variety for sustainable and profitable fodder production in this region. According to Sarker *et.al* (2021), Cultivars and locations had a significant ($p<0.001$) effect on biomass yield, plant height and leaf-stem ratio. Considering those points in mind, eight (8) new varieties of fodders such as Zara, Signal, C04, Guinea, Andropogan, Rozi, Plicatulum, and Dal have been conserved to the fodder germplasm bank. The objective of this experiment was to evaluate the production performance and nutrient components of three different varieties of Napier fodder. There were three treatments with four replications and treatments were T_1= BLRI Napier-3, T_2= Red Pakchang, and T_3= BLRI Napier-4, and each of the plot size was 150m.^{2} Three soil samples collected from each fodder plot were analyzed from the Soil Resource Development Institute, Divisional Laboratory, Rajshahi. The production parameters of high yielding fodder variety at 1st, 2nd, and 3rd cutting were recorded. The collected data were analyzed through one-way analysis of variance using SPSS 22.0 statistical program. No significant differences ($p>0.05$) were found in biomass yield, plant height, leaf number, tiller number, and stem perimeter among the treatment's groups. However, the production performance of BLRI Napier-4 showed numerically higher value compared to the average mean value. Significant differences ($p<0.05$) were found in at 1st, 2nd, and 3rd cutting. Nutrient composition of three cultivars was varied significantly ($p<0.05$) (Table 4). In conclusion, BLRI Napier-4 is better in terms of production parameters and ADF value than other cultivars. Further investigations with more samples are needed to draw a precise conclusion.

Productive and reproductive performance of BLRI developed dairy crossbred cattle

Crossbred cows are popular to farmers because they produce more milk than indigenous cows. Crossbreeding of indigenous cattle with exotic breeds of high genetic potential could be considered a rapid and effective method for the genetic improvement of dairy animals. Crossbreeding without proper records leads to genetic dilution of the promising indigenous cattle. Moreover, most of the crossbred genotypes are genetically admixed with several breeds, which are not justified for a breed development program. In consequence, limited systematic information on the crossbred cattle population is available in the country. Thus, it is necessary to establish crossbred dairy cattle by crossing a known purebred native cows with exotic bulls to determine the actual productive and reproductive performance of the crossbred. In this perspective, Bangladesh Livestock Research Institute (BLRI) has taken the initiative to establish a crossbred dairy cattle herd of 50% Holstein Friesian (HF) × 50% Pabna cattle at Regional station, BLRI, Baghabari. A nucleus herd of indigenous Pabna cattle was established at the regional station (RS), BLRI, Baghabari in 2017 before conducting crossbreeding program. Productive and reproductive data were recorded throughout the year in both hard and soft forms. The independent sample *t-test* was performed to compare the mean value using the SPSS 22.0 statistical program. Table 1 showed the present population of dairy crossbred cattle (49) consisting of 21 males and 28 females and purebred Pabna cattle (62) involving 40 females, and 22 males. Highly significant ($p<0.001$) differences were found in body weights at birth, 6-month, 12-month, 18-month, and 24-month of ages between dairy crossbred and purebred Pabna cattle (Table 2). Average daily gain (ADG) was found significant difference between dairy crossbred and purebred Pabna cattle at birth to 6 months, 6-12 months, 18-24 months, birth- 24 months except 12-18 months of age (Table 3). Weight at puberty (kg), age at first conception (days), and age at first calving (days) were found significant difference between two groups except age of puberty (days) (Table 4). Total milk yield (l), average milk yield (l/d) at 105 days were found 651.62±114.58, 6.21±1.09 and 290.84±28.51, 2.77±0.27 for dairy crossbred and purebred Pabna cattle, respectively. In conclusion, newly developed dairy crossbred cattle by crossing 100% HF with pure Indigenous Pabna cows would be a suitable for sustainable and profitable dairy farming in the changing climatic condition of Bangladesh.

BLRI Regional Station, Naikhongchari, Bandarban FY 2022-23

BLRI Regional Station, Naikhongchari, Bandarban is one of the largest regional stations of BLRI, that is located at Naikhongchari Upazilla under Bandarban hill tract district. It was established in 1989-1990 with an area of 162.91 acres land.

A. Research Works

Reinforcement of Regional Livestock Research at Naikhongchari

The research was undertaken for the conservation and improvement of livestock, poultry and fodder germplasm in the hilly region of Naikhongchari. The objectives were to conserve and improve different livestock, poultry and fodder germplasm suitable for hilly region; to promote the various High Yielding Fodders (HYFs) in hilly area; to develop a tick control package for livestock and poultry in hilly region and to promote the feed technologies at the research farm. The research found the average litter size of Hilly Brown Bengal goat was 1.8±0.01 (n=37), average birth weight, 3 months body weight and average daily gain up to 3 months for male and female kids were found 1.36±0.06 kg (15), 1.30±0.03 kg (27), 5.27±0.61 kg (6), 4.99±0.35 kg (14), 41.41±5.95 g (6) and 40.18±3.97 g (14), respectively. The average egg weight was 44.91±3.1 g, fertility and hatchability rate were observed as 82%, 68.5%, average DOC weight, average male and female body weight at 60 days were found 30.85±2.46 g, 539.5±83.5 g and 494.0±76.3 g, respectively. The average fresh biomass yield of BLRI Napier-3, Napier Pakchong and Red Napier was found as 34.84t/ha, 30.84t/ha and 27.49t/ha, respectively. The highest tick free duration was observed in sheep for the second time treatment protocol and the lowest tick free duration was observed in goats for second time treatment protocol. Therefore, this study reveals that a minimum of three times of ivermectin with malathion administration is needed to control ticks over the year which is more cost effective for the livestock farm than the usual practice of dipping at 1- month interval. The highest average daily gain (182.21 g) was found in the UTS group and the lowest ADG (108.27 g) was observed in the control group. The highest body weight (15.69±0.34 kg) was found in the case of the UTS feeding group whereas 15.46±0.27 kg and 10.16±0.55 kg was observed in the UMS and control feeding group, respectively.

Current genetic resources with their statistics

Sl No	Species	Number	Class based on age and sex
1	Brown bengal goat	305	Buck-72, Doe-112, Wether-8, Kids-113
2	Native sheep	179	Ram-33, Ewe-52, Wether-3, Lamb-91
3	Gayal	10	Male-3, Female-6, calf-1
4	Deer	34	Stag-16, Hind-16, Fawn-2

Sl No	Species	Number	Class based on age and sex
5	Hilly chicken	482	Cock-143, Hen-206, Chicks-133
6	Jungle fowl chicken	104	Cock-45, Hen-59
7	Red chittagong cattle	63	Bull-2, Cow-38, Heifer-7, Calves-16

1) Conservation and improvement of Hilly Chicken, Jungle Fowl Chicken

Different types of data on Hilly Chicken and Jungle fowl i.e. body weight, egg weight, hatchability, fertility and daily feed intake were collected and analyzed for the conservation and improvement of hilly chicken and jungle fowl chicken. Selection and culling method were used. Vaccination, medication, deworming, debeaking, artificial insemination and other routine activities were also done regularly.

Fig 1. Hilly chicken and jungle fowl

2) Conservation and Improvement of Red Chittagong Cattle, Goat, Sheep, Gayal and Deer

The productive and reproductive data of RCC cattle, Brown Bengal goat, native sheep, were recorded and analyzed for characterization. Routine activities such as vaccination, medication and deworming, dipping, shearing, castration, culling and mating were done in a scientific way for the betterment of farm animals. Conserve the farm animals namely deer and gayal in the hilly areas from extinction.

Fig 2. RCC Cattle, Brown Bengal goat, Native Sheep, Gayal and Deer at research farm

3) Conservation of Fodder Germplasm at Research Area

Establishment of fodder germplasm and introduction of various improved fodders at research farm. Production, cultivation and processing of different types perennial HY fodders and seasonal fodders. Fifteen fodders germplasm exists in the germplasm bank. These are: Napier-1, Napier-2, Napier-3, Napier-4, Red Napier, Napier Packchong, German, Para, Signal, Splendida, Rozi, Andropogon, Cow pea, Maize, Oat etc.

Fig 3. Fodder germplasm at research farm

B. Others Activities

1) Office Laboratory

Collection of samples (animal faeces, blood etc.) from research farm and community. Carefully analyzed and recorded the result of the samples and give suggestions to overcome the problems. Regular post-mortem of animals and birds were done and kept record.

Fig 4. Collection of samples, sample analysis and post-mortem of farm animals and poultry

2) Training Program

Training programs were arranged at Naikhongchari Regional Station during the fiscal year 2022-23 to disseminate ideas about beef fattening, cattle, sheep, goat and poultry rearing and management system. In those training program around 120 beneficiaries were participated.

Fig 5. Training program at BLRI regional station, Naikhongchari, Bandarban

3) Backyard Meeting Program

Twelve backyard meeting were organized at different locations of Naikhongchari, Bandarban to enhance awareness among the farmers about livestock and poultry rearing. In the backyard meeting, farmers get necessary information about feeding, breeding, care, management and disease control of their animal and poultry species.

Fig 6. Backyard meeting at farmer's yard

4) Technical support to Livestock and Poultry Farmers

Technical support was provided to the farmers about modern livestock rearing and health management. In 2022-23 FY, near about 313 farmers had taken suggestion about animal rearing, poultry rearing, animal and poultry health management, fodder cultivation and preservation. Besides, near about 56500 fodder cuttings including HYV Napier, Red Napier, Para, German, Packchong were distributed among the farmers in hilly region. This station also provides vaccination facilities to the farmers in Naikhongchari region. Normally vaccination program was conducted against PPR, sheep and goat pox, BCRDV, RDV, fowl pox and so on under BLRI Technology Village. De-worming drugs were also provided to the selected farmers at a regular interval.

Fig 7. Distribution of fodder cuttings and regular vaccination among the farmers

5) Distribution of sheep, goat, hilly chicken, fertile egg

Native sheep, brown Bengal buck, ram, hilly chicken and fertile eggs were distributed among the interested farmer based on their application. In the last 2022-23 FY year 4862 fertile hilly chicken's eggs were distributed. This regional station also distributes the above mentions inputs through different project work.

Fig 8. Distribution of hilly chicken among the farmers in Naikhongchari

6) Field visit

Field visit is very important to boost up the activities under community level. Frequent field visit was conducted with a view to identify the problems faced by the farmers and suggest them how to solve the problems in a scientific way. It also helps to exchange ideas with the livestock farmers.

Fig 9. Field visit at different places of Naikhongchari hilly area

BLRI Regional station, Bhanga, Faridpur Annual Report (2022-23)

The BLRI Faridpur Regional Station was established in 2019 under the Fodder Research and Development Project to strengthen livestock development and improve rural livelihoods in the area. It carried out region-specific research to overcome local production challenges and promoted the efficient use of available feed and fodder resources. Serving as a center for innovation, the station developed and transferred improved technologies that enhanced farmers' productivity and profitability. It also strengthened animal health services through disease monitoring, vaccine evaluation, and preventive health programs suited to the Faridpur context. In addition to research, the station built the capacity of farmers, women, and youth by providing training and demonstrations on modern livestock practices, while encouraging the adoption of climate-resilient methods aligned with local agro-ecological conditions. Overall, the Faridpur Regional Livestock Research Station played a vital role in advancing food security, reducing poverty, and supporting rural economic growth at both divisional and national levels through its various activities.

Fodder germplasm bank

The Fodder Germplasm Bank was established at the Faridpur Regional Livestock Research Station to conserve and maintain high-yielding, climate-resilient fodder varieties, ensuring systematic multiplication and year-round availability of quality planting materials for farmers, researchers, and development partners. By supplying fodder resources according to stakeholder needs, it strengthened community-based fodder supply systems. This initiative directly enhanced fodder productivity andreduced seasonal feed shortages, thereby improving livestock feeding practices. Approximately 1 acre of land was utilized for cultivating different HYV fodders under this germplasm bank, which played a significant role in boosting livestock productivity, profitability, and overall rural development in the region. Six high-yielding fodder varieties were preserved in the bank, including Napier-3, Napier-4, Pakchong, Red Pakchong, German, and Jara.In 2022-23 FY around 600500 fodder cuttings were distributed different stakeholder of this region as per demands.

Fig 1: HYV Fodder germplasm bank

Duck farm demonstration

A duck farm demonstration unit was established at the Faridpur Regional Livestock Research Station to introduce improved BLRI-developed Rupali and Nageshwari ducks at the village level. The farm supplied quality hatching eggs and ensured a reliable source of healthy day-old ducklings based on farmers' needs. By demonstrating improved duck farming systems, it enhanced farmers' skills in better management practices for increased productivity. This initiative boosted both meat and egg production, thereby contributing to food security and income generation in rural households. Ultimately, the duck demonstration farm served as a model for sustainable duck production and technology dissemination across the region.

Fig 2: Duck demonstration shed

Farmers training

Farmers' training at the Faridpur Regional Station was vital for building capacity in modern and scientific livestock management. Through specialized training on scientific duck and chicken rearing, beef fattening, profitable dairy farming, and sustainable fodder production, farmers gained practical knowledge to improve their practices. The training programs also served as a platform for sharing new innovations and research findings directly with concerned farmers. By adopting improved techniques, farmers were able to significantly increase meat, milk, and egg production, ensuring better access to animal protein for communities. Ultimately, such training enhanced farmers' income, strengthened livelihoods, and contributed to overall social and economic upliftment in the region. During 2022–23, a total of 180 male and female farmers received hands-on training in six batches on popular BLRI technologies such as improved poultry and goat farming.

Fig 3: Farmers training

Distribution of hatching eggs

Hatching eggs of Rupali and Nageshwari ducks were distributed to encourage the adoption of improved breeds among farmers. To support duck farming, a total of 2,216 hatching eggs were supplied at a low cost to interested nearby duck rearers during the 2022–23 fiscal year.

Fig 4: Distributed duckling and hatching egg distribution

Technical support

The Station provided technical support to surrounding farmers engaged in chicken, duck, goat, cattle, and other livestock production. Farmers received guidance on scientific practices such as housing design, improved feeding systems, health care, and disease management to enhance productivity. The station also assisted with marketing strategies, efficient rearing methods, and sustainable waste management to promote environmentally friendly livestock farming. By offering such comprehensive support, the station enabled farmers to adopt modern practices that improved production efficiency, income generation, and long-term sustainability. In this context, a total of 153 livestock-based farmers received technical knowledge-sharing guidance during the 2022–23 fiscal years.

Fig 5: Technical support

Model village concept

The BLRI Model Village was designed to evaluate the impact of improved technologies compared to traditional practices. Region-specific BLRI-developed innovations were applied and validated in the beneficiary group, ensuring practical solutions for local livestock challenges. Key interventions included native chicken rearing, duck rearing, beef fattening, and silage- and TMR-based feeding systems, all of which showed promising results. Through this approach, farmers achieved higher production and demonstrated strong willingness to adopt these technologies, proving the effectiveness of the model village concept.

BLRI regional station, Jashore
Annual Report 2022 -23

BLRI regional station, Jashore, established in 2019 under the fodder development research project only three acres of land. This regional station is established as the target of the huge potential of the Khulna Division to expand the production of the poultry and livestock sector. The main mandate of the BLRI regional station, Jashore, is to identify the problem of the livestock sector in the Khulna division and find out the possible solutions to set specific goal-oriented sustainable research programs to develop technology. To achieve the goal and increase the production of livestock each year, we have done some activities in our regional station. These works are shown in some major titles and pictorial views.

1. Different Fodder cutting distribution

Twelve varieties of fodder are conserved at the BLRI regional station in Jashore, which are then distributed to farmers to minimize their feed costs. During the 2022-23 fiscal year, we distributed approximately 63,500 fodder cuttings to over 15 farmers.

Fig.1 Fodder cutting distribution

2. Conservation and development of native geese production

A flock of approximately 80 geese is kept in a dedicated rearing shed. Their growth and development are meticulously managed through scientific practices, and the eggs they lay are hatched on a regular basis.

Fig.2 Production and conservation of native geese

3. Farmer's Training

The BLRI regional station in Jashore hosted two training programs to share knowledge about cattle fattening and poultry rearing and management. A total of 90 farmers attended the programs.

Fig.3 Farmers training

4. Different technology demonstration and advisory services to farmers

Advisory services were provided to 93 farmers on various topics, including fodder production management, cattle and poultry feed, farm management, and biosecurity. Farmers also received hands-on training on how to make silage and prepare concentrate feed mixtures.

Fig.4 Technology demonstration

5. Technical Support to Livestock and Poultry Farmers

We provided technical support to farmers on modern livestock rearing and housing management. We also conducted the first deworming and a vaccination program in Madhugram, Jashore, covering PPR (Peste des Petits Ruminants), FMD (Foot-and-Mouth Disease), BCRDV (Baby Chick Ranikhet Disease Vaccine), RDV (Ranikhet Disease Vaccine), Duck Cholera, and Duck Plague.

Fig.4 Technology demonstration

6. Backyard meeting

We held a backyard meeting on indigenous chicken rearing systems, including a demonstration of different feed formulations and a detailed vaccination schedule for cattle, sheep, goats, chickens, ducks, and geese.

Fig.5 Backyard meeting

BLRI Regional Station, Rajabarihat, Godagari, Rajshahi Annual Report (2022-23)

Introduction

Bangladesh Livestock Research Institute (BLRI), Godagari, Rajshahi is the second largest regional station of BLRI holding about 27 acres of land. The primary aim of establishing the regional station is conducting intensive research on livestock and poultry species to identify the problems, potentialities, invention as well as dissemination of suitable livestock and poultry technologies. It allows to identify and address Barind livestock problems and climate resilient fodder that facilitates to make farmers need based research activities. It contributes to transfer BLRI developed techonogies to farmers. It also provides a platform for training farmers and entrepreneurs on new livestock technologies, management techniques and disease prevention. This helps bridge the gap between the research and practical application which improves farmers livelihood due to increasing the livestock production. BLRI Rajshahi, Regional station plays a vital role for fostering region specific livestock development, improving productivity , supporting farmers and contributing the overall economy of Bangladesh.

1. Conservation and improvement of RCC, Goat and Poultry:

The regional station contributes to the conservation and improvement of indigenous livestock breed (RCC and Black Bengal Goat) and poultry breeds (common deshi, naked neck and hilly) that are well adapted to local conditions. The productive and reproductive data are recorded. Routine activities according to BLRI developed guidelines like vaccination, deworming, dipping, castration, culling and mating are done for the betterment of farm animals.

Fig. 1 Naked neck

Fig. 2 Hilly

Fig. 3 Common deshi

Fig.4 Black Bengal goat

Fig. 5 RCC

2. Conservation of seasonal and perennial fodder at the Research Farm:

Establishing of fodder germplasm bank having seven varieties of perennial high yielding fodder (like Napier 1,2,3,4, red pakchong, German, Rozi) were conserved and seasonal fodders like maize, sargham, oats were cultivated at research farm.

Fig.6 Fodder germplasm bank

3. Distribution of fodder cuttings:

Fodder cuttings were distributed among the interested farmers based on their application. About 25000 cuttings were distributed to the farmers in 2022-23 Fiscal year.

Fig.7 Distribution of cuttings

4. Training program:

Training programs are critically important for livestock farmers as they serve as a powerful tool for modernizing practices, improving productivity, and enhancing livelihoods. The benefits of such training extend from the individual farmer to the broader community and economy.Training program was held at this regional station to share the knowledge of scientific livestock rearing, management, fodder cultivation, prevention of diseases and introducing new technology. During 2023-23 FY, a total 250 numbers of beneficiaries attended training program and developed their skill for livestock and poultry farming.

Fig.8 Training program

5. Backyard meeting:

Backyard meetings are incredibly important for livestock farming, especially for small-scale and peri-urban farmers. They provide a vital platform for knowledge sharing, community building and addressing common challenges. Backyard meetings were arranged at the different sites of Godagari upazilla so that farmers could perceive successful management, breeding techniques, feeding strategies, adaptation of new technology for their enhancing livestock production. During 2022-23 FY, six (6) backyard meetings were completed.

Fig.9 Bcakyard meeting

6. Technical support to the livestock and poultry farmers:

The Station provides technical support to the farmers. Farmers take guidance on scientific practices including housing design, improved feeding systems, health care, and disease management to enhance productivity. A total of 150 number farmers received technical knowledge sharing guidance during 2022–23 the fiscal year.

7. Activities of model village:

We conducted the first deworming and a vaccination program Kamalapur, Godagari, covering PPR (Peste des Petits Ruminants), FMD (Foot-and-Mouth Disease), BCRDV (Baby Chick Ranikhet Disease Vaccine), RDV (Ranikhet Disease Vaccine), Duck Cholera, and Duck Plague. We also demonastrated TMR, UMS, UTS technology for livestock improvement.

Fig.10 Activities of BLRI Technology village

8. Celebration of different important days

Independence day, victory day, International mother language day etc national days were celebrated with due respect.

Fig. 11 Drawing competition and prize distribution on victory day

Research Farm

Nine subject-based research departments are working under BLRI. All of these departments receive administrative support from the support services department. Research Farm works as a section under the Support Service Division. The support services department assists all of these departments with administrative tasks. The Research Farm, a branch of the Support Service Department, provides various services to other departments that are involved in research such as fodder and feed-based research, cattle and buffalo conservation and improvement, animal feeding trials and so on In research regards to accomplish BLRI mission and vision. To carry out this local and foreign beef and milking buffalo breeds (Murrah and Nili Ravi), BLRI Cattle Breed-1 (BCB-I), Red Chittagong Cattle (RCC), Munshigonj Cattle are conserved at the BLRI Cattle and Buffalo Research Farm. Additionally, 55 (fifty five) different types of fodders (low land , high land, salt tolerant, draught tolerant) that are preserved in BLRI Fodder germplasm bank. To enhance the overall quality of our livestock population, large Argo-based Industries, DLS, and many Institutes receive year-round fodder cuttings and breeding stocks, especially RCC Breeding Bull, from Research farm for research and extension activities.

Breeding stock for BCB-1

Category	Present Number
Milking Cows	20
Dry Cows	45
Adult bulls (Teaser, Brahman & breeding)	28
Heifers (Weaning to before puberty)	22
Growing bulls (Weaning to before adult)	12
Milk calf (Female)	20
Milk calf (Male)	17
Total	164

Breeding stock for RCC Cattle

Category	Present Number
Milking Cows	29
Dry Cows	80
Adult bulls(Adults & breeding)	34
Heifers (Weaning to before puberty)	36
Growing bulls (Weaning to before adult)	35
Milk calf (Female)	38
Milk calf (Male)	35
Total	287

Breeding stock for Beef Cattle

Category	Present Number
Milking Cows	6
Dry Cows	8
Adult bulls(Adults & breeding)	15
Heifers (Weaning to before puberty)	1
Growing bulls (Weaning to before adult)	1
Milk calf (Female)	14
Milk calf (Male)	11
Total	56

Breeding stock for Munshigonj Cattle

Category	Present Number
Milking Cows	4
Dry Cows	6
Adult bulls(Adults & breeding)	13
Heifers (Weaning to before puberty)	6
Growing bulls (Weaning to before adult)	2
Milk calf (Female)	2
Milk calf (Male)	2
Total	35

Breeding stock for Buffaloes

Category	Present Number
Milking Cows	12
Dry Cows	20
Adult bulls(Adults & breeding)	7
Heifers (Weaning to before puberty)	64
Growing bulls (Weaning to before adult)	25
Milk calf (Female)	10
Milk calf (Male)	13
Total	151

Annual fodder cultivation and distribution Plan (2022-23)

Sl No.	Plot no.	Land (Hec)	Fodder	Work schedule	Fodder Production	Comments
1	F1	1	Napier	Cutting, Transplant, Cow dung & Urea supply	230	Fresh Grass Supply -220 (Ton)
2	F2	3	Napier BLRI-3	Cutting, Transplant, Cow dung & Urea supply	280	Fresh Grass Supply -260 (Ton
3	F6	3	Napier	Cutting, Transplant, Cow dung& Urea supply	100	Silage-150 (Ton)
4	F7	3	Triticale &Maize	Cutting, Transplant, Cow dung Urea supply& Silage	90	Fresh Grass Supply -70(Ton)
5	P1	7	Maize & Oats	Cultivation, Cow dung & Urea supply	220	Fresh Grass Supply– 210(Ton)
6	L1	4	Oats	Cultivation, Cow dung & Urea supply	170	Fresh Grass Supply- 150(Ton)
7	L2	3	German	Cutting, transplant & urea supply	150	Fresh Grass Supply- 140(Ton)
8	L3	3	German	Cutting, transplant & urea supply	170	Fresh Grass Supply- 140(Ton
9	L4	3	German	Cutting, transplant & urea supply	220	Fresh Grass Supply-210 (Ton)
10	L5	2	German	Cutting, transplant & urea supply	120	Fresh Grass Supply- 110(Ton
11	M1-R1	1	Splendida	Cutting, transplant & urea supply	90	Fresh Grass Supply-60 (Ton)
14	F8-F10	8	Napier	Cutting, Transplant, Cow dung Urea supply& Silage	350	Silage-310(Ton)

Sl No.	Plot no.	Land (Hec)	Fodder	Work schedule	Fodder Production	Comments
15	J1	2	Splendida	Cutting, transplant & urea supply	140	Fresh Grass Supply-130 (Ton)
16	H1	2	Oats	Cutting &Urea supply	140	Fresh Grass Supply-130 (Ton)
17	H2	2	Oats	Cutting &Urea supply	120	Fresh Grass Supply-100(Ton)
18	H3	0.5	Oats	Cutting &Urea supply	100	Fresh Grass Supply-85 (Ton)
19	H4	0.5	Napier	Cutting, transplant & urea supply	120	Fresh Grass Supply-100(Ton)
20	H5	0.5	Napier	Cutting, transplant & urea supply	90	Fresh Grass Supply-60 (Ton)
21	H6	0.5	Napier	Cutting, transplant & urea supply	80	Fresh Grass Supply-60(Ton)
22	H7	0.5	Napier	Cutting, transplant & urea supply	100	Fresh Grass Supply-70(Ton)

Fresh Grass Supply-2305 ton, Silage- 460 Ton; Grand Total – 2765 Ton

Cuttings from various fodder cultivars and the delivery of seeds to various stakeholders (farmers, businesses) during (2022–2023)

Sl No.	Name of Germplasm	No of Cuttings Distribution	No of Farmers Cutting Taken
1	Napier(3&4 variety)	650000	165
2	Packchong	400000	60
3	German	165000	34
4	Para	35000	13
5	Oats(kg)	1100	8

Engineering Section

Engineering Section under Support Service Division has been working from the beginning of the Institute. The Section is headed by Executive Engineer (Civil) with 1 (one) Assistant Engineer (Civil), 1 (one) Assistant Engineer (Instrument/ Electronics), 2 (two) Sub-Assistant Engineer (Civil), 1 (one) Sub-Assistant Engineer (Electronics), 2 (two) Electrician and 1 (one) Mason.

Under mentioned development and repair/ renovation/maintenance works has been implemented by the Engineering Section under revenue budget & development project during financial year (2022-2023).

A. Under revenue budget (Repair and renovation works)

Sl. No.	Name or works	Qty.	Unit	Year	Value of works in Lakh Tk.
1.	Repair of Residential Building	1.00	L.S	2022-2023	40.00
2.	Repair of other Building and Infrastructures	1.00	L.S	2022-2023	40.00
3.	Others Repair & Maintenance (Water, Electricity & Gas)	1.00	L.S	2022-2023	40.00
4.	Repair & Maintenance of Equipments & Furniture.	1.00	L.S	2022-2023	25.00
	Sub –Total Tk.=				**145.00**

B. Under development Project

Sl. No.	Name or works	Qty.	Unit	Year	Value of works in Lakh Tk.
1.	Black Bengal Goat Conservation and Development Research Project				
	a. Repair & maintenance of Goat Shed# 1,2, G-3,4,6, G-8, Compost Shed, Dipping Channel & Animal Production Building Lab. Room #402 at BLRI H.Q, Savar, Dhaka.	1.00	L.S	2022-2023	25.00
	b. Repair of Goat Shed, Goat farm office & Lab room at BLRI H.Q, Savar, Dhaka. (RFQ)	1.00	L.S	2022-2023	9.98
				Sub-Total Tk. =	**34.98**

Sl. No.	Name or works	Qty.	Unit	Year	Value of works in Lakh Tk.
2.	Strengthening of Poultry Research and Development Project				
	a. Construction of External Electrification works at BLRI H.Q, Savar, Dhaka	1.00	L.S	2022-2023	12.84
	b. Extension of Existing Duck Shed with Construction of RCC Yard Infront of F-1 Quarter at BLRI, Savar, Dhaka (RFQ)	1.00	L.S	2022-2023	4.48
	c. Construction of Duck Exhibition Research Shed at BLRI Regional Station, Bhanga, Faridpur (RFQ)	1.00	L.S	2022-2023	9.99
	d. Construction of Duck Exhibition Research Shed at BLRI Regional Station, Godagari, Rajshahi (RFQ)	1.00	L.S	2022-2023	9.99
	e. Construction of Duck Exhibition Research Shed at BLRI Regional Station, Saidpur, Nilphamari (RFQ)	1.00	L.S	2022-2023	9.99
	f. Extension of Hatching Building at BLRI, Savar, Dhaka (RFQ # 03,04,05 & 06)	1.00	L.S	2022-2023	39.93
	g. Repair & Interior works of Project Director office, SPRDP, BLRI, Savar, Dhaka	1.00	L.S	2022-2023	9.65
				Sub-Total Tk. =	**96.87**
3.	**Buffalo Research and Development Project**				
	a. Construction of RCC Road at BLRI H.Q, Savar, Dhaka	1.00	L.S	2022-2023	41.81
	b. Construction of Buffalo Calf Shed with Yard at BLRI H.Q, Savar, Dhaka	1.00	No	2022-2023	61.04
	c. Construction of Master Drain at BLRI Regional Station, Godagari, Rajshahi	1.00	No	2022-2023	25.03
	d. Construction of Growing Buffalo Shed with Yard at BLRI H.Q, Savar, Dhaka	1.00	L.S	2022-2023	94.97
	e. Construction of Buffalo Cow Shed at BLRI Regional Station, Rajshahi	1.00	L.S	2022-2023	122.36
	f. Construction of Buffalo Breeding Bull Shed with Yard at BLRI Regional Station, Rajshahi	1.00	L.S	2022-2023	95.00

Sl. No.	Name or works	Qty.	Unit	Year	Value of works in Lakh Tk.
	g. Renovation of Pond for Buffalo wallowing by Site Cleaning, water discharging, Earth work in walkway Embankment & Site Development at BLRI Buffalo Farm, H,Q, Savar, Dhaka (RFQ)	1.00	L.S	2022-2023	9.99
	h. Site Development at Buffalo Quarantine Shed, BLRI H,Q, Savar, Dhaka. (RFQ)	1.00	L.S	2022-2023	5.99
	g. Construction of Buffalo Semen Collection Shed at BLRI Regional Station, Godagari, Rajshahi. (RFQ)	1.00	L.S	2022-2023	4.79
				Sub-Total Tk. =	**460.98**
				Grand Total Tk. =	**737.83**

Publication Section

BLRI Publishes Various Publications includes Journal, Annual Report, Proceeding, Newsletter, Scientific monographs, Leaflets, Bulletins, Technical papers, Research reports, Brochure. The Institute also publishes others Publications, Following is the list of Publications:

No.	Journal Publication
1.	Bangladesh Journal of Livestock Research, Vol. 1, No. 1, July-1993
2.	Bangladesh Journal of Livestock Research, Vol. 2, January-1994 to Vol. 5 No.2, January-1998
3.	Bangladesh Journal of Livestock Research, Vol. 6, No. 1 & 2, January-1999. June-2002
4.	Bangladesh Journal of Livestock Research, Vol.7, No. 1 & 2, January-2000 and Vol.8, No. 1 & 2, January-1001, June-2002
5.	Bangladesh Journal of Livestock Research, Vol.9, No.9, No.1 (Jan-June)-2002 and Vol.9, No.2 (July-Dec.) 2004, June-2004
6.	Bangladesh Journal of Livestock Research, Vol. 10, No.10, No.1 (Jan-June)-2003 and Vol. 10, No.2 (July-Dec.)-2003, June-2004
7.	Bangladesh Journal of Livestock Research, Vol. 11, No. 1 (Jan-June) & No.2 (July-Dec.)-2004 November-2005
8.	Bangladesh Journal of Livestock Research, Vol. 12, No.1 & 2, (Jan.-June and July-Dec.)-2005, March-2007
9.	Bangladesh Journal of Livestock Research, Vol. 13, No. 1 & 2, (Jan.-June and July-Dec.)-2006, June-2007
10.	Bangladesh Journal of Livestock Research, Vol. 13, No. 1 & 2, (Jan.-June and July-Dec.)-2007, June-2008
11.	Bangladesh Journal of Livestock Research, Vol. 15, No. 1 & 2, (Jan.-June and July-Dec.)-2008, June-2009
12.	Bangladesh Journal of Livestock Research, Vol. 16, No. 1 & 2, (Jan.-June and July-Dec.)-2009, June-2010
13.	Bangladesh Journal of Livestock Research, Vol.16, No. 1&2, (Jan.-June and July-Dec.)-2010, June-2011
14.	Bangladesh Journal of Livestock Research, Vol. 18, No. 1&2, (Jan.-June and July-Dec.)-2011, June-2010
15.	Bangladesh Journal of Livestock Research, Vol. 19, No.1, (Jan.-June) and No.2 (July-Dec.)-2012, June-2013
16.	Bangladesh Journal of Livestock Research, Vol. 20, No.1, (Jan.-June) and No.2 (July-Dec.)-2013, May -2016
17.	Bangladesh Journal of Livestock Research, Special Vol. 21-25, 2018, June-2019
18.	Bangladesh Journal of Livestock Research, Vol. 26, No.1, (Jan.-June) and No.2 (July-Dec.) 2019, June-2021

No.	
19.	Bangladesh Journal of Livestock Research, Vol. 27, No.1, (Jan.-June) and No.2 (July-Dec.) 2020, June-2021
20.	Bangladesh Journal of Livestock Research, Vol. 28, No.1, (Jan.-June) and No.2 (July-Dec.) 2021, June-2024
21.	Bangladesh Journal of Livestock Research, Vol. 29, No.1, (Jan.-June) and No.2 (July-Dec.) 2022, June-2024
	Annual Report
22.	Annual Report (Progress Report)-1985-91, July-1991
23.	Annual Report(1992-93 to 1997-98, June-2002
24.	Annual Report-1999, December-2002
25.	Annual Report-2000, June-2004
26.	Annual Report-2001, February-2005
27.	Annual Report-2002, December-2005
28.	Annual Report-2003, June-2006
29.	Annual Report-2004, December-2006
30.	Annual Report-2005-2006, June-2007
31.	Annual Report-2007, June-2008
32.	Annual Report-2008, June-2009
33.	Annual Report-2009, June-2010
34.	Annual Report-2010, June-2011
35.	Annual Report, 2011, June-2012
36.	Annual Report-2012, June-2013
37.	Annual Report-2013, June-2014
38.	Annual Report-2014, June-2015
39.	Annual Report, 2015, June-2016
40.	Annual Report-2016, August-2017
41.	Annual Report-2017, June-2018
42.	Annual Report-2018, June-2019
43.	Annual Report-2019, June-2023
44.	Annual Report-2021, June-2024
45.	Annual Report-2022, June-2024
46.	Annual Report-2023, January-2025
	Proceedings
47.	First Annual Livestock Research Workshop Proceedings, Bangladesh Livestock Research Institute, Nov. 20,1986
48.	Bangladesh Livestock Research Institute (BLRI), Progress of Research, October-1988
49.	Proceeding of Workshop on Livestock Development in Bangladesh, 16-18 July-1991
50.	Proceedings o0f the Workshop on Livestock Research in Bangladesh, February-2, 1992

No.	
51.	Annual Research Review Workshop- 2003, June,11-12 ,2003
52.	Proceedings of Annual Research Review Workshop-2004, June-28-29,2004
53.	Annual Research Review Workshop-2005, April-25-26,2005
54.	Annual Research Review Workshop-2006, June-15-16,2006
55.	Annual Research Review Workshop-2007, June-13-14,2007
56.	Annual Research Review Workshop-2008, June-17-18,2008
57.	Annual Research Review Workshop-2009, June-15-16,2009
58.	Annual Research Review Workshop-2010, June-22-23,2010
59.	Proceedings of the Annual Research Review Workshop-2009-2010, June-2011
60.	Annual Research Review Workshop-2011, June-28-29,2011
61.	Proceeding of the Annual Research Review Workshop-2010-2011, May-2012
62.	Annual Research Review Workshop-2012, June-2425-2012
63.	Proceeding of the Annual Research Review Workshop-2012-2013, December-2014
64.	Proceeding of the Annual Research Review Workshop-2013-2014, October-2015
65.	Proceeding of the Annual Research Review Workshop-2014-2015, April, 2017
66.	Proceeding of the Annual Research Review Workshop-2015-2016, June -2018
67.	Proceeding of the Annual Research Review Workshop-2016-2017, June -2018
68.	Proceeding of the Annual Research Review Workshop-2017-2018, October -2018
69.	Proceeding of the Annual Research Review Workshop-2018-2019, June -2019
70.	Proceeding of the Annual Research Review Workshop-2019-2020, December -2020
71.	Proceeding of the Annual Research Review Workshop-2020-2021, January - 2022
72.	Proceeding of the Annual Research Review Workshop-2021-2022, December -2022
73.	Proceeding of the Annual Research Review Workshop-2022-2023, December -2023
Newsletter	
74.	BLRI Newsletter Vol. 1 No. 1, December 1989
75.	BLRI Newsletter Vol. 2 No. 1, March 1991
76.	BLRI Newsletter Vol.1 issues No. 1&2, 2010
77.	BLRI Newsletter Vol.2 Issues No. 1&2, 2011
78.	BLRI Newsletter Vol.2 Issues No. 3&4, 2011
79.	BLRI Newsletter Vol.3 Issues No. 1&2, 2012
80.	BLRI Newsletter Vol.5 issues No. 1&2, 2014
81.	BLRI Newsletter Vol.6 issues No. 1&2, 2014
82.	BLRI Newsletter Vol.7 issues No. 1, 2,3&4, 2016
83.	BLRI Newsletter Vol.8 issues No. 1,2,3 & 4, 2017
84.	BLRI Newsletter Vol.9 issues No. 1,2,3 & 4, 2018
85.	BLRI Newsletter Vol.10 Issues No. 1,2,3 & 4, 2019
86.	BLRI Newsletter Vol.11 Issues No. 1,2,3 & 4, 2020
87.	BLRI Newsletter Vol.12 Issues No. 1,2,3& 4, 2021

No.		
88.	BLRI Newsletter Vol.13 issues No. 1&2,3 & 4, 2022	
89.	BLRI Newsletter Vol.13 issues No. 1&2, 2023	
	Other Publications	
90.	বন্যার পর গবাদি পশু ও হাঁস-মুরগির জন্য চাষী ভাইদের করণীয়	
91.	ইপিল ইপিল, পশু উৎপাদন গবেষণা বিভাগ	
92.	Black Bengal Goat Under Stall-Fed Condition, APRD	
93.	Completed, on-going and Future Studies and project program of Animal Production Research Division, BLRI	
94.	Effect of molasses supplementation of roughage based diet on growth performance of cattle	
95.	গবাদি পশুর ক্ষুরারোগ ও তার দমন ব্যবস্থা	
96.	বাংলাদেশী ভেড়ার জাতসমূহ ও এর বৈশিষ্ট্য শীর্ষক পোস্টার	
97.	'পোল্ট্রি খামারে জৈব নিরাপত্তা' শীর্ষক পোস্টার	
98.	Laboratory Manual for Homologous Goat pox Vaccine Production, June-2007	
99.	আবদ্ধ অবস্থায় কাল ছাগল পালন	
100.	ছাগল উৎপাদন বৃদ্ধির মাধ্যমে দারিদ্র্য বিমোচন	
101.	Sugarcane utilization as a dual purpose crop for sustainable livestock farming	
102.	Development of beef cattle breed using Gayal (*Bos frontalis*)	
103.	কর্ন স্ট্র প্যালেট ফিডঃ বিএলআরআই কর্তৃক উদ্ভাবিত একটি পূর্ণাঙ্গ গো-খাদ্য শিল্প প্রযুক্তি	
104.	মুরগির রোগ নিয়ন্ত্রণ ব্যবস্থাপনা প্রশিক্ষণ সহায়িকা	
105.	লাভজনক দুগ্ধ খামারের জন্য নেপিয়ার (নেপিয়ার বাজরা) ঘাস চাষ	
106.	আরসিসি চিটাগাং অঞ্চলের একটি অষ্টমুখী লাল গরু	
107.	লেয়ার মুরগি পালন নির্দেশিকা	
108.	Foot and Mouth Disease	
109.	কবুতর পালন	
110.	Reproductive Performances of Cows in Savar Dairy Farm	
111.	Memorandum of Agreement Between BLRI and DLS on Hand-over of Savar Farm to BLRI	
112.	Livestock Sub-sector in Bangladesh: Status and Development Potentials.	
113.	1963-85	Abstracts of Research in Parasitology in Bangladesh. 1963-1985
114.	1986-90	Poultry Production Research Division. Research Report-1986-90
115.	1988-89	Epidemiology of Foot and Mouth Disease in Bangladesh and Selection of Vaccines Virus Strains. Annual Report-19988-89
116.	1988-89	Proceedings of the Workshop on the Achievement of Research Under PL 480 Title-III, 1988-89, February-1990
117.	1989-90	Report on Farming System Research. FSR Report No. 1, 1989-1990
118.	1989-90	Performance of Black Bengal Goat under Stall-fed condition, 1989-1990
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203.	2002	মুরগির সালমোনেসিস রোগ নির্ণয় ও দমনে পুরোরাম এন্টিজেন, প্রথম সংস্করণ, জুন-২০০২
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229.	2007	পোল্ট্রি খামারের জীব নিরাপত্তা নিশ্চিত করণের লক্ষ্যে নিম্নের বিষয় গুলির প্রতি সতর্ক থাকা উচিত, মার্চ- ২০০৭
230.	2007	ভেড়ার খাদ্য ব্যবস্থাপনা, ডিসেম্বর- ২০০৭
231.	2007	পিপিআর ভাইরাসের বিরুদ্ধে এন্টিবডি নির্ণয়ে C-DISAপদ্ধতি, জুন- ২০০৭
232.	2007	BLRI-A Brief Acquaintance, June-2007
233.	2007	'বিশ্বে ভেড়ার জাত ও বাংলাদেশে প্রাপ্ত ভেড়াসমূহ' শীর্ষক পোস্টার, জুন- ২০০৭
234.	2007	পশুসম্পদ ও পোল্ট্রি উৎপাদন প্রযুক্তি নির্দেশিকা, পরিমার্জিত সংস্করণ, জুন ২০০৭
235.	2008	উচ্চ ফলনশীল ঘাসের চাষ, দ্বিতীয় সংস্করণ, নভেম্বর-২০০৮
236.	2008	স্টল ফিডিং পদ্ধতিতে ভেড়া পালন, প্রথম সংস্করণ, এপ্রিল-২০০৮
237.	2008	দেশী ভেড়ার প্রজনন পরিকল্পনা ও ব্যবস্থাপনা, প্রথম সংস্করণ, মে-২০০৮
238.	2008	ভেড়ার ফুটরট রোগের চিকিৎসা, প্রথম সংস্করণ, মে-২০০৮
239.	2008	ভেড়ার বহিঃপরজীবীর প্রতিরোধ ও চিকিৎসা, প্রথম সংস্করণ, মে-২০০৮
240.	2008	ভেড়ার প্রজনন ব্যবস্থাপনা, মে-২০০৮
241.	2008	ক্ষুদ্র খামারীদের জন্য ছাগল পালন পদ্ধতি, প্রথম সংস্করণ, জুন-২০০৮
242.	2008	মহিষ পালন ব্যবস্থাপনা, প্রথম সংস্করণ, জুন-২০০৮
243.	2008	ভেড়া পালন নির্দেশিকা, প্রথম সংস্করণ, জুন-২০০৮
244.	2008	ছাগলের বাচ্চার প্রতি পালন, ২য় সংস্করণ, নভেম্বর-২০০৮
245.	2008	এভিয়ান ইনফ্লুয়েঞ্জা প্রতিরোধে জীব নিরাপত্তা নির্দেশিকা, সেপ্টেম্বর-২০০৮
246.	2008	ব্রয়লার পালন নির্দেশিকা, প্রথম সংস্করণ, সেপ্টেম্বর-২০০৮
247.	2009	মুরগির গামবোরো রোগ নিয়ন্ত্রণের কার্যকর পদ্ধতি, দ্বিতীয় সংস্করণ, নভেম্বর-২০০৯
248.	2009	মুরগির রানীক্ষেত রোগ নিয়ন্ত্রণের কার্যকর পদ্ধতি, দ্বিতীয় সংস্করণ, নভেম্বর-২০০৯
249.	2009	এইচআই (HI) পরীক্ষার জন্য ফিল্টার পেপারের সাহায্যে রক্ত নমুনা সংগ্রহ পদ্ধতি, দ্বিতীয় সংস্করণ, নভেম্বর-২০০৯
250.	2009	বাণিজ্যিক মুরগির খামারে জীব নিরাপত্তা ব্যবস্থাপনা, প্রকাশকালঃ নভেম্বর-২০০৯
251.	2009	মুরগির সালামোনেলা রোগঃ প্রতিরোধ ও নিয়ন্ত্রণ পদ্ধতি, দ্বিতীয় সংস্করণ, নভেম্বর-২০০৯
252.	2009	মুরগির খামারের বর্জ্য ব্যবস্থাপনা ও কম্পোস্টিং, দ্বিতীয় সংস্করণ, নভেম্বর-২০০৯
253.	2009	পশুসম্পদ ও পোল্ট্রি উৎপাদন প্রযুক্তি নির্দেশিকা তৃতীয় সংস্করণ, জুন-২০০৯
254.	2009	দেশী ভেড়ার পশম হতে ঘরে বসে চাদর, শাল ও মাদুর তৈরির সহজ পদ্ধতি, প্রথম সংস্করণ, মার্চ-২০০৯

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255.	2009	ভেড়ার বাচ্চার প্রতিপালন, মার্চ-২০০৯
256.	2009	A Study on Highly Pathogenic Avian Influenza in Bangladesh, June-2009
257.	2009	মুরগির কৃত্রিম প্রজননের সহজ পদ্ধতি, প্রথম সংস্করণ, জুন-২০০৯
258.	2009	ফডার থেকে ডিএনএ (DNA) পৃথকীকরণের সহজ পদ্ধতি, প্রথম সংস্করণ, জুন-২০০৯
259.	2009	মাইকোটক্সিন নিয়ন্ত্রণের উপায়, প্রথম সংস্করণ, জুন-২০০৯
260.	2009	রক্তের নমুনা থেকে ডিএনএ নিষ্কাশন, প্রথম সংস্করণ, জুন-২০০৯
261.	2009	ক্ষুদ্র পোল্ট্রি খামারীদের 'খামার ব্যবস্থাপনা' বিষয়ে প্রযুক্তি হস্তান্তর কর্মকর্তার নিকট প্রতিনিয়ত প্রশ্ন ও জবাব, প্রথম সংস্করণ, নভেম্বর-২০০৯
262.	2009	কৃত্রিম গো-প্রজনন ম্যানুয়েল, প্রথম সংস্করণ, জুন-২০০৯
263.	2009	ভেড়ার খামার জীব নিরাপত্তা, প্রথম সংস্করণ, নভেম্বর- ২০০৯
264.	2010	ভেড়াপালন নির্দেশিকা, ২য় সংস্করণ, অক্টোবর- ২০১০
265.	2010	অ্যানথ্রাক্স বা তড়কা রোগ আতঙ্ক নয়, প্রয়োজন সচেতনতা, আগস্ট- ২০১০
266.	2010	পশুসম্পদ ও পোল্ট্রি উৎপাদন প্রযুক্তি নির্দেশিকা, ২য় সংস্করণ, জুন- ২০১০
267.	2010	ভেড়ার খাদ্য ও পুষ্টি ব্যবস্থাপনা, প্রথম সংস্করণ, জুন-২০১০
268.	2011	ভেড়ার ব্যাপক অ্যালোপেসিয়া (লোমউঠা) রোগের কারণ, লক্ষণ ও প্রতিকার, মার্চ- ২০১১
269.	2011	ছাগলের ঠান্ডা-সর্দি নিরাময়ে বা নিউমোনিয়া প্রতিরোধে তুলসী পাতার ব্যবহার, মার্চ- ২০১১
270.	2011	শুভ্রা বিএলআরআই কর্তৃক উদ্ভাবিত লেয়ার স্ট্রেইন-১, জুলাই- ২০১১
271.	2012	MUN: a Modern Diagnostic Tool for Improvement of Dairy Nutrition, September-2012
272.	2012	এক নজরে বিএলআরআই-২০১২
273.	2012	বার্ষিক টিকা প্রদান ও কৃমিনাশক কর্মসূচি-২০১২
274.	2013	আঞ্চলিক প্রাণিস্বাস্থ্য ও পুষ্টি ল্যাবরেটরির কার্যক্রম ও সেবাসমূহ, ২০১৩
275.	2013	বার্ষিক টিকা প্রদান ও কৃমিনাশক কর্মসূচি- ২০১৩
276.	2013	তাপ-সহিষ্ণু পিপিআর ভ্যাকসিন, ২০১৩
277.	2013	বাছুরের জন্য সাট পাউডার ভিত্তিক মিল্ক রিপ্লেসার, ২০১৩
278.	2013	বহুবর্ষজীবী উচ্চফলনশীল ঘাস বিএলআরআই নেপিয়ার- ৪, ২০১৩
279.	2013	ড্রাম সাইলেজ- ২০১৩
280.	2013	বাংলা ল্যাম্ব- ২০১৩
281.	2013	বার্ষিক প্রতিবেদন ২০১২, জুন- ২০১৩
282.	2013	বিএলআরআই নিউজ লেটার- ২০১৩
283.	2013	দেশী ভেড়ার ফিতা কৃমির সংক্রামণ ও প্রতিকারের উপায়, ডিসেম্বর- ২০১৩
284.	2013	ভেড়ার টক্সোপ্লাজমোসিস ও প্রতিকার, ডিসেম্বর- ২০১৩
285.	2014	ভেড়ার প্রেগন্যানসি টক্সিমিয়া (একটি বিপাকীয় রোগ) এর কারণ, লক্ষণ ও প্রতিকার, ফেব্রুয়ারী- ২০০৪

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286.	2014	ভেড়ার খামারে ডিওয়ামিং ডিপিং ভ্যাকসিনেশন, ফেব্রুয়ারী- ২০১৪
287.	2014	প্রজননের জন্য মহিষ বাঁড় নির্বাচন ও পালন ব্যবস্থাপনা, ফেব্রুয়ারী- ২০০৪
288.	2014	মহিষের অন্তঃ পরজীবী বা কৃমি দমন, মে- ২০১৪
289.	2014	ভেড়ীর গর্ভফুল আটকে যাওয়াঃ কারণ, লক্ষণ ও চিকিৎসা, মে- ২০১৪
290.	2014	প্রাণিসম্পদ ও পোল্ট্রি উন্নয়ন প্রযুক্তি ভিত্তিক প্রশিক্ষণ মডিউল, জুন- ২০১৪
291.	2014	দুধের মিনি পাস্তুরিকরণ ও সংরক্ষণ প্রযুক্তি, জুন- ২০১৪
292.	2014	ভেড়ার নিউমোনিয়া প্রতিরোধ ভেষজ উদ্ভিদ তুলসী, আগস্ট- ২০১৪
293.	2014	আর্থ-সামাজিক উন্নয়ন দারিদ্র্য বিমোচনে ভেড়া পালন, সেপ্টেম্বর- ২০১৪
294.	2014	উন্নত ব্যবস্থাপনার মাধ্যমে দেশি ভেড়ার প্রজনন, ডিসেম্বর- ২০১৪
295.	2014	ভেড়ার খাদ্য হিসেবে সাইলেজ ও ইউ এম এস তৈরির পদ্ধতি ও ব্যবহার, ডিসেম্বর- ২০১৪
296.	2015	ডোল পদ্ধতিতে কাঁচা ঘাস সংরক্ষণ প্রযুক্তি, জুন ২০১৫
297.	2016	গবাদী প্রাণীর মারাত্মক সংক্রামক ক্ষুরারোগ ও এর নিয়ন্ত্রণ ব্যবস্থাপনা, জানুয়ারী- ২০১৬
298.	2015	দানাদার খাদ্যের বিকল্প হিসেবে সাজনা পাতা ও কচি ডালপালা ব্যবহার করে বাড়ন্ত ভেড়া মোটাতাজাকরণ, অক্টোবর, ২০১৫
299.	2016	দেশী ভেড়ার পশম, পাট ও তুলার মিশ্রণে তৈরি সুতা থেকে শাল, কম্বল ও স্যুটিং কাপড় তৈরির পদ্ধতি, সেপ্টেম্বর- ২০১৬
300.	2016	সম্ভাবনাময় দেশীয় জাতের মুরগি পালন, মে, ২০১৬
301.	2016	এক নজরে বিএলআরআই আঞ্চলিক কেন্দ্র নাইক্ষ্যংছড়ি, বান্দরবান
302.	2016	ছাগলের পিপিআর রোগ মুক্তকরণে বিএলআরআই মডেল, জুন- ২০১৬
303.	2017	বিএলআরআই এ বিদেশী ভেড়ার সফল কোয়ারেন্টাইন, জানুয়ারী- ২০১৭
304.	2017	ল্যাম্ব (ভেড়ার মাংস) উৎপাদনে ইউএমএস এর ব্যবহার, এপ্রিল- ২০১৭
305.	2017	ল্যাম্ব উৎপাদনে গর্ভবতী ভেড়ী ও বাচ্চার খাদ্যের পুষ্টি ব্যবস্থাপনা, মে -২০১৭
306.	2017	এক নজরে বিএলআরআই আঞ্চলিক কেন্দ্র বাঘাবাড়ী, শাহাজাদপুর, সিরাজগঞ্জ, মে-২ ০১৭
307.	2017	বাণিজ্যিক ল্যাম্ব (ভেড়ার মাংস) উৎপাদনে স্থানীয় জাতের ভেড়ার উপযোগীতা, জুন- ২০১৭
308.	2017	মহিষের ইস্ট্রাস-সিনক্রোনাইজেশন প্রযুক্তি , জুন ২০১৭ খ্রিঃ
309.	2017	নর্থ বেঙ্গল গ্রে জাতের দেশী গরু, আগস্ট- ২০১৭
310.	2017	মুন্সিগঞ্জ জাতের দেশী গরু, জুলাই- ২০১৭
311.	2018	বিএলআরআই ম্যাসটাইটিস টেস্ট (বিএমটি) কিট, জুন-২০১৮
312.	2018	খামারি পর্যায়ে টার্কি পালন ও ব্যবস্থাপনা, জুন- ২০১৮
313.	2019	ডেইরী শিল্পের নিরব ঘাতকঃ অ্যানাপ্লাজমোসিস রোগের কারণ, লক্ষণ ও প্রতিকার, জানুয়ারি- ২০১৯
314.	2019	ডেইরী উন্নয়ন পাবনা জাতের দেশী গরু, জানুয়ারি - ২০১৯
315.	2019	আবদ্ধ আবাসস্থায় মায়া হরিণ পালন ও ব্যবস্থাপনা, মার্চ- ২০১৯
316.	2019	বাংলাদেশে গবাদি প্রাণীতে রক্ত প্রোটোজোয়ার প্রকোপ ও এর নিয়ন্ত্রণ ব্যবস্থাপনা, জুন- ২০১৯

No.		
317.	2019	এক নজরে বায়োটেকনোলজি বিভাগের কার্যক্রম, অক্টোবর- ২০১৯
318.	2021	মহিষের উৎপাদনশীলতা বৃদ্ধিতে সরকারের যুগান্তকারী পদক্ষেপ, মে-২০২১
319.	2021	খামারী পর্যায়ে মহিষের তথ্য সংরক্ষণের হার্ডবুক, মে-২০২১
320.	2021	মহিষ পালন খামারী প্রশিক্ষণ ম্যানুয়াল, জুন-২০২১
321.	2021	লাভজনক খামার ব্যবস্থাপনায় বিএলআরআই ফিডমাস্টার মোবাইল অ্যাপ্লিকেশন এর ব্যবহার, জুন-২০২১
322.	2021	বাংলাদেশ জার্নাল অব লাইভস্টক রিসার্চ ভলিউম-২৬, জুন-২০২১
323.	2021	বাংলাদেশ জার্নাল অব লাইভস্টক রিসার্চ ভলিউম-২৭, জুন-২০২১
324.	2021	প্রসিডিংস অব দ্যা অ্যানুয়াল রিসার্চ রিভিউ ওয়ার্কসপ ২০১৭-১৮, জুন-২০২১
325.	2021	গাভী পালন ও ব্যবস্থাপনায় উন্নত প্রযুক্তির ব্যবহার, ডিসেম্বর, ২০২১
326.	2022	বিএলআরআই প্রযুক্তি পল্লী, ফেব্রুয়ারি ২০২২
327.	2022	বিএলআরআই ব্রিডিং ম্যানেজার মোবাইল অ্যাপস, মার্চ ২০২২
328.	2022	গ্রীনওয়ে বিজনেস অ্যাপস, মার্চ ২০২২
329.	2022	দেশীয় ভেড়াঃ বাংলাদেশ প্রাণিসম্পদ গবেষণা ইনস্টিটিউট এ সংরক্ষণ ও উন্নয়ন, এপ্রিল ২০২২
330.	2022	তথ্য অধিকার আইন ও এর বিধিবিধান, জুন ২০২২
331.	2022	প্রোবায়োটিক দই তৈরিতে বিএলআরআই স্টার্টার কালচার
332.	2022	স্বল্প খরচে এবং সহজে হিমায়িত সিমেন উৎপাদন প্রযুক্তি
333.	2022	বিএলআরআই ঘাস-৫ (লবণ সহিষ্ণু)
334.	2022	বিএলআরআই মিট চিকেন-১ (সুবর্ণ) প্যারেন্ট ব্যবস্থাপনা গাইডলাইন
335.	2023	ক্রসব্রিডিং এর মাধ্যমে দেশীয় জাতের ভেড়ার উন্নয়ন সম্ভাবনা

Packages and Technologies Developed by BLRI

A. Packages

Sl. No	Name of Package	Year developed
1.	Cattle Fattening	1998
2.	Health management package to control PPR	1999
3.	Quail rearing	2000
4.	Calf rearing	2002
5.	Dairy Farming	2002
6.	Forage production and preservation	2002
7.	Goat rearing model for poverty alleviation	2002
8.	Rearing of Black Bengal goats under semi-intensive management	2002
9.	Commercial layer model for small farmers	2002
10.	FMD control measures	2002
11.	Goat rearing under stall-fed condition	2003
12.	Broiler rearing under model for small farmers	2003
13.	Duck rearing in rural area	2003
14.	Rabbit rearing model for small farmers	2004
15.	Gumboro disease control package	2004
16.	Newcastle disease control package	2004
17.	Cockerel rearing	2005
18.	Management of Sheep Breeding and Genetics	2007
19.	Pigeon Rearing	2009

B. Technologies

Sl. No	Name of Technologies	Year developed
1.	Salmonella vaccine	1995
2.	ELISA- based techniques for the diagnosis	1995
3.	Salmonella antigen for the diagnosis of pullorum disease	1995
4.	Use of coconut, mustard oil cake and ipil-ipil leaf meal in the poultry diet	1997
5.	Urea-Molasses-Straw (UMS)-a basal feed for cattle	1998
6.	Appropriate exotic blood level for crossbreeding program of dairy cattle	1998
7.	Straw preservation under wet condition	1998
8.	Urea-Molasses Block preservation technique	1998
9.	Algae production and its use as an alternative feed for ruminants	1998
10.	Low cost preservation of green grass	1998

Sl. No	Name of Technologies	Year developed
11.	Molasses utilization as a feed for cattle	1998
12.	Livestock feed and fuel production from cultivation of Ipilipil	1998
13.	Maize and cowpea mixed forage production and utilization	1998
14.	Combined antibiotic hyper immune serum therapy for PPR	1999
15.	Hygienic and improved chick brooder	2001
16.	PPR vaccine	2001
17.	C-ELISA method for antibody determination against PPR virus	2001
18.	Enzyme Immuno Slide Assay (ELISA) for diagnosis of PPR and Rinderpest disease	2001
19.	Banana foliage processing and preservation for feeding cattle Sugarcane by-products processing and preservation for feeding cattle	2002
20.	Sugarcane by-products processing and preservation for feeding cattle	2002
21.	Manure-based year-round duckweed production and its utilization for feeding livestock and poultry	2002
22.	Dairy cattle development through artificial insemination and selection techniques	2002
23.	Control model for gastro- intestinal helminth parasites	2002
24.	Mycoplasma antigen	2002
25.	Improved technique for the production of organic chicken	2002
26.	Techniques for selection of best genotypes of Black Bengal goat for farm establishment	2002
27.	Manufacturing process of Astagram Ponir (cheese) and its marketing	2003
28.	Embryo transfer technique use in native cows	2003
29.	Baksa-a native grass production and its use in dairy cattle	2003
30.	Maize stover preservation and its use for feeding cattle	2003
31.	Pruning level of jackfruit leaves and system of feeding to goat	2003
32.	ND antigen for HI test	2003
33.	Bio-security in commercial poultry farms	2003
34.	Filter Paper-strip blood collection method for HI test	2003
35.	Fodder crop production for saline belt, flood prone and Madhupur tract	2004
36.	Fodder production on the hill slopes for livestock production and to alleviate soil erosion	2004
37.	Hemolysin for complement fixation test	2004
38.	Goat kid management	2006
39.	ELISA method for determination of Goat pox disease	2006
40.	Goat pox Vaccine	2007

Sl. No	Name of Technologies	Year developed
41.	'Mina Mix' as source of mineral for livestock	2009
42.	Corn straw Pellet Feed	2010
43.	Shuvra-BLRI Layer Strain-I	2011
44.	Non-electric chick brooder	2011
45.	Thermostable PPR Vaccine	2012
46.	Naplar-4 High yielding grass	2012
47.	BLRM DNA Extraction Kit	2012
48.	Milk replacer for calves	2012
49.	Bio-security model for commercial small scale poultry farmer	2012
50.	বিএলআরআই এফএমডি ২০১৬ ত্রিযোজি (O, A, Asia-1) টিকার মাস্টার সীড	2016
51.	ছাগল ও ভেড়ার পিপিআর রোগ দমনে বিএলআরআই মডেল	2016
52.	বিএলআরআই ফিড মাস্টার মোবাইল এপ্লিকেশন	2016
53.	গবেষণাগারে ভ্রূণ উৎপাদন	2016
54.	প্রজননের জন্য মহিষ ষাঁড় নির্বাচন ও পালন ব্যবস্থাপনা	2016
55.	মহিষ খামারে অন্তঃপরজীবী বা কৃমি দমন মডেল	2016
56.	মহিষ খামারে জীব নিরাপত্তা ব্যবস্থাপনা	2017
57.	বিএলআরআই লেয়ার স্ট্রেইন২- বা "স্বর্ণা"	2017
58.	ব্রয়লার খাদ্যে এন্টিবায়োটিকের বিকল্প হিসেবে সাজনা পাতার ব্যবহার	2017
59.	মহিষের ইস্ট্রাস-সিনক্রোনাইজেশন প্রযুক্তি	2017
60.	ঢোল পদ্ধতিতে কাঁচা ঘাস সংরক্ষণ প্রযুক্তি	2017
61.	উন্নত জাতের দেশি মুরগি উৎপাদনে বিজ্ঞান সম্মত কৌশল	2017
62.	এভিয়ান ইনফ্লুয়েঞ্জা (H_5N_1) এইচআই (HI) পরীক্ষার জন্য (HA) এইচএ এন্টিজেন	2017
63.	সাজনা গাছের চাষ পদ্ধতি এবং গো-খাদ্য হিসেবে এর ব্যবহার	2018
64.	শস্য-উপজাতভিত্তিক প্রাণী খাদ্য হিসাবে টি.এম.আর প্রযুক্তি	2018
65.	ক্ষুরারোগ দমনে বিএলআরআই মডেল	2018
66.	পাহাড়ি অঞ্চলে ভেড়া পালনের কৌশল	2019
67.	নিরাপদ মাংস উৎপাদনে দেশি উপকূলীয় মহিষ হৃষ্টপুষ্টকরণ প্রযুক্তি	2019
68.	দেশি ভেড়া হতে বাণিজ্যিক ভিত্তিতে বাংলা ল্যাম্ব (ভেড়ার মাংস) উৎপাদন	2019
69.	সবজি বর্জ্য থেকে প্রাণিখাদ্য উৎপাদন প্রযুক্তি	2020
70.	ফডারের বায়োমেট্রিক্যাল র‍্যাংকিং টুল	2020
71.	স্টল ফিডিং পদ্ধতিতে ছাগল ও ভেড়া পালনে "সাশ্রয়ী কমপ্লিট প্যালেট ফিড" এর ব্যবহার	2021
72.	বিএলআরআই ঘাস-৫ (লবণ সহিষ্ণু)	2022
73.	বিএলআরআই মিট চিকেন-১ (সুবর্ণ)	2022

Public Relation Section

Information Service:

Public Relations section of BLRI has provided information according to 19 applications under Right to Information Act, 2009. Beside these formal applications, information has also been provided to farmers and interested entrepreneurs about BLRI technologies and ongoing services through face to face communication, phone, massage and social media.

Publicity on National Days:

Public Relations section of BLRI is observing different national and international days and publishing their news in different news media and social platforms. This section also operating the display board of main gate and administration building to circulate significant speech of on various occasions along with important news and documentaries about BLRI.

Press and Media:

Public Relations section of BLRI is proving assistance to press and media continuously. This section is proving them information and guideline about the technologies and achievements of BLRI as well as providing concepts or ideas of features. Public Relations section also provides press brief and press release to the national daily and online media about different important programs of BLRI.

Fig.1 : BLRI news in different media

BLRI Newsletter:

Public Relations section of BLRI is publishing BLRI Newsletter quarterly in collaboration of Publication section. Four issues of BLRI Newsletter (Volume-13, Issue- 3, 4 and Volume-14, Issue- 1, 2) has been published on 2022-2023 financial year.

Fig. 2: Front page of BLRI Newsletter

Website Management:

In collaboration of ICT section, Public Relations section is also contributing in the development of BLRI website and keeping it up to date. The section updates and the recent data and information about BLRI time to time. Beside this, PR section also posts pictures in home slider and news in Recent News section of the website.

Fig-3: Picture published in BLRI website

Social Media:

Public Relations section also maintains the social media sites of BLRI. There is an official Facebook page as well as a Facebook group of BLRI. BLRI also has an official YouTube channel. PR section maintains these accounts, keeps them up to date and conducts publicity through these page, group and channel. The section also provide QnA through the accounts also.

Fig-4: Post about BLRI event and heat management massage published on BLRI Facebook page

APA Managements:

Under the Annual Performance Agreement 2022-23 and according to the Right to Information Regarding Work Plan 2022-23, Public Relations section has been performed various activities in 2022-23 financial year. Besides disposing the applications made under the RTI act, the section also updates the Self-Disclosable Information List twice in the year. The section had also published advertisement regarding RTI in the official website of BLRI and national daily. The section had also helped the Training section in arranging 3 (Three) training programs.

Awareness Programs:

Public Relations section of BLRI is playing an important role in increasing awareness about RTI and related subjects among BLRI stakeholders, farmers and general citizens. PR section of BLRI had published advertisement regarding RTI in the official website of BLRI and national daily. The section also published leaflets about the importance of RTI. Farmers, who come to take trainings, are also made aware of RTI in details. PR section has also arranged 02 (Two) stakeholders meeting about RTI with the In-Charges of BLRI sub-stations and other stakeholders.

Library Section

BLRI library which functions as a resource center is constantly being enriched. BLRI maintains the library to support the research, training and disseminate the research findings and activities of the institute's researchers. This support is provided through a variety of activities as stated below. BLRI library has been continued to extend its various facilities to the researchers, including those in the regional stations at various places in the country. Some services were also enjoyed by persons other than the BLRI officer-staff.

Library use: More than 500 users including researchers, research support personnel, administrator and trainees from both within and outside the institute take advantage of the library's major facilities and services. Among the outside reader-visitors, the university students, M.Phil and Ph.D Student, scientists and researchers from various NGO's, Savar Dairy Farm, RV & F Depot and Military Dairy Farm use this library frequently. The library's infrastructure facilities and physical environment is constantly being improved. The reference service, Document delivery, dissemination channels, automated library service and on-line facilities are under-way to further improve with a view to making it a specialized library for livestock research in country and more useful to the users. BLRI library is open Sunday through Thursday, from 9:00 a.m. to 5:00 p.m.

Collection development: The authority is always careful to increase the library collection, upgrade its services and improve the information support for the scientists and researchers of the institute. The authority also allocates a regular revenue and project budget in every financial year to purchase reading materials for the library. The library received a remarkable number of journal & workshop proceedings, conventional and non-conventional research reports, annual reports, newsletters and magazines etc. on complimentary or exchange basis. The library always monitored the needs of the scientists of the Institute for scientific literature and took special care to procure those in the fastest possible way. Total number of books 8217; among them 39 are e-books, Journals title 200 and reports about 1500 in the BLRI library respectively. Recently as the part of online journal collections BLRI has newly added agriculture based online journal AGORA which is conducted by 'Research for Life' as well as a world prominent e-journal database 'The Essential Electronic Agricultural Library (TEEAL)' newly added with BLRI library services.

Photocopying service: There are photocopy machines in the library to improve the document delivery services and information support such as CAS, SDI etc. to facilitate the researchers. The library's photocopying service is made available to them as needed. Number of 75,335 Photocopy materials has been delivered for official and research purposes for the year 2023-24.

Computer: One personal computer was acquired for the library to facilitate word processing and database related work. Another one personal computer was added from NATP Project BARC to develop library database. New database process is underway to computerize the library collections in near future to strengthen information retrieval facilities.

Borrowing facilities: The library's borrowing facilities were made available as usual to the researchers, administrators, M.Phil students, Ph.D students, scientists, officers and staffs of the institute and those of the RV & F Depot, Savar Dairy Farm (on a limited basis). The library maintained formal relationship with the SAIC, AIC, BAU Library, BANSDOC Library, BARI Library, Jahangirnagar University Library and BPATC Library.

Reference service: The library staffs are often required to find answers to formal/ informal reference queries, they are committed to response the queries and to check various reference citations.

Accounts Section

Financial Statement for the Year 2022-2023 (Revenue Budget)

Taka in lakh

Economic Code	Particular	Total budget	Total expenditure	Balance
3111101	Officers Salary	606.00	597.02	8.98
3111201	Staff Salary	385.35	379.18	6.17
3631102	Allowances	643.35	624.18	19.17
3631103	Supply & Service	1562.04	1551.97	10.07
3631104	Retirement allowance Gratuity	348.06	348.06	-
3421506	Contributory provident fund	99.00	99.00	
3257103	Research	375.00	375.00	-
3631199	Others Grant	30.75	30.69	0.06
	Grand total	4049.55	4005.10	
	Revenue Budget Adjustment	(-)99.00	(-)99.00	
	GOB Net Expenditure	3950.55	3906.10	44.45

ICT infrastructure and activities at BLRI

Bangladesh Livestock Research Institute (BLRI) has improved its Information Communication Technology (ICT) infrastructure and services for R&D and other official activities. Recently the server room has been structurally enriched after installing some valuable devices like Powerfull Servers with server racks, CISCO network equipment, Online UPS and other related accessories. Server room rearranged with raced-floor and now it is almost well-equipped. Important areas of office building and research farm areas are now under IP Camera based surveillance system. Two regional sub centers Baghabari, Sirajgong and Naikhongchari, Banderaban of BLRI are also under IP Camera based surveillance system. BLRI is now connected it's all office including regional stations with IPTSP system. Employees are communicating each other through IP phone using internet. BLRI has developed some mobile application for citizen's which is using all over the country.

Fig.1: Server room And Surveillance system

BLRI is electronically connected with Bangladesh Research and Education Network (BdREN) to use different ICT related servicer of University Grants Commission (UGC). (VPN). Scientists are using The Essential Electronic Agricultural Library (TEEAL), a digital library of research

Fig. 2: TEEAL database.

Fig. 3 : www.blri.gov.bd

In the agricultural and related sciences and accessing more than 465,000 full-text PDF articles from over 350 (1990-2011) international journals using Local Area Network (LAN). All office buildings are connected through underground optical fiber backbone including some farm areas. All office rooms, laboratories, library, conference room, guest house and DG's Bangla are connected to the LAN. Scientists and officials are getting the facilities such as file or data sharing, print sharing, communicating among themselves through the LAN for better R & D activities. Dedicated 100 Mbps full duplex Internet connectivity is attached to the LAN. Scientists and officials are using 24 hours uninterruptible Internet from every computer under the LAN. Some areas of office are under wireless Internet connection (WI-FI). Internet is accessible through mobile device like Smart phone, Tablet PCs, Laptop etc. Scientists are communicating with different international Research Institute, Universities and related organization for better R&D activities by using Internet. Updated R & D information, news, reports, and other activities are available in BLRI official website http://www.blri.gov.bd both in Bangla and English language.

Fig. 4: Video conference room

BLRI is started using Internet Protocol (IP) based intercom phone service for better communication. Regional stations also connected with IP phone. Regional offices are also connected with the local IP based Intercom. Now a dedicated International standard video conference system is available at BLRI. Training, meeting or any other international research collaboration and online communication is available from BLRI.

Store & Procurement Section

Annual Report 2022-23

SI NO.	Description	Tk. (Lakh)
01	Animal & Poultry Feed	715.00
02	Stationery Items	8.13
03	Computers, Laptop and UPS	18.58
04	Liveries	2.95
05	Furniture	3.00
06	Repair, maintenance, expansion and supply of BLRI LAN, Central Wi-Fi system, re-engineering of data center networking internet connectivity, upgradation of online requisition system and attendance management system of BLRI.	16.85
07	Sanitary & Plumbing goods	8.76
08	Electrical goods.	9.59
09	Milk Keeping Poly-Pack & Other accessories	2.98
10	Printing, Binding & Supply of BLRI Annual Report-2019	2.15
11	Video Documentary	3.00
12	Printing, Binding & Supply of Proceedings for Annual Research Review Workshop-2022	1.90
13	Printing, Binding and Supply of BLRI MC-1 (Shuborno) Parent Management Guideline Manual.	1.57
14	Spare parts of vehicle.	3.00
15	Book	2.00
	Total	799.46

List of Personnel-2023
(Not in the order of Seniority)

No.	Name	Designation
1.	Shakila Faruque, PhD (Animal Breeding & Genetics)	Chief scientific Officer (R.C.)
2.	S.M. Jahangir Hossain, PhD (Animal Breeding & Genetics)	Chief scientific Officer
3.	Nasrin Sultana, PhD (Animal Nutrition)	Chief Scientific Officer
4.	Md. Zillur Rahman PhD (Animal Nutrition)	Principal Scientific Officer
5.	Biplop Kumar Roy, PhD (Livestock Production Management)	Principal Scientific Officer
6.	Md. Sazedul Karim Sarker, PhD (Poultry Nutrition)	Principal Scientific Officer
7.	Most. Parvin Mostari, PhD (Neuroendocirnology & Animal Reproduction)	Principal Scientific Officer
8.	Gautam Kumar Deb, PhD (Reproductive Biotechnology)	Principal Scientific Officer
9.	Sardar Muhammad Amanullah, PhD (Applied Life Science)	Principal Scientific Officer
10.	Razia Khatun, PhD (Food Safety)	Principal Scientific Officer
11.	Kamurn Nahar Monira, PhD (Animal Breeding & Genetics)	Principal Scientific Officer
12.	Dr. Md. Nuruzzaman Munsi, M.S. (Theriogenology), PhD	Principal Scientific Officer
13.	Md. Rakibul Hassan, PhD (Agriculture poultry nutrition of physiology)	Principal Scientific Officer
14.	Sadek Ahmed, PhD (Animal Nutrition)	Principal Scientific Officer
15.	Mohammed Abdus Samad, PhD (Bio-medical Engineering)	Principal Scientific Officer
16.	Mohammad Lutful Haque, M.Sc. (Informatics and Computer Engineering.)	System Analyst
17.	Md. Shahin Alam, PhD	Principal Scientific Officer
18.	Mohammad Abdur Rashid, PhD	Principal Scientific Officer
19.	Shamim Ahmed, PhD	Principal Scientific Officer
20.	Halima Khatun, PhD	Principal Scientific Officer
21.	Mohammad Sirajul Islam, PhD	Principal Scientific Officer
22.	Md. Ashraful Islam, B.Sc,(Civil Engg.) MBA (F&B) MIEB	Executive Engineer
23.	Noni Gopal Das, M.S. (Animal Science) PhD fellow	Senior Scientific Officer
24.	Farhana Afroz, PhD fellow	Senior Scientific Officer
25.	Md. Asadul Alam, PhD fellow	Senior Scientific Officer
26.	Md. Yousuf Ali, M.S. (Poultry Science) PhD fellow	Senior Scientific Officer
27.	Yousuf Ali Khan, M.S. (Animal Breeding & Genetics)	Senior Scientific Officer
28.	Md. Khairul Basar, M.S. (Poultry Science) PhD fellow	Senior Scientific Officer
29.	Dr. Md. Saiful Islam PhD	Senior Scientific Officer

No.	Name	Designation
30.	Md. Rezaul Karim, M.S. (Microbiology) PhD	Senior Scientific Officer
31.	Md. Nazmul Huda, B.Sc. & AH. (Hon's) PhD fellow	Senior Scientific Officer
32.	Md. Abu Hemayet, MS. (Poultry Science) PhD fellow	Senior Scientific Officer
33.	Md. Hafizur Rahman, M.S. (Microbiology) PhD	Senior Scientific Officer
34.	Md. Masud Rana, M.S. (Poultry Science) PhD	Senior Scientific Officer
35.	Md. Rezaul Hai Rakib, B.Sc, (A.H.) Hon's PhD fellow	Senior Scientific Officer
36.	Md. Abu Yousuf, M.S. (Pathology)	Senior Scientific Officer
37.	Mrs. Mahafuza Khatun, PhD fellow	Senior Training Officer
38.	Ponir Chowdhury M.S. (Animal Breeding & Genetics) PhD fellow	Senior Scientific Officer
39.	Md. Mukhlesur Rahman, M.Sc. (Animal Nutrition)	Senior Scientific Officer
40.	Md. Ahsanul Kabir, M.S. (Dairy Science) PhD fellow	Senior Scientific Officer
41.	Md. Zakir Hassan, M.S (Medicine) PhD fellow	Senior Scientific Officer
42.	Md. Anwar Hossain, M.S. (Microbiology)	Senior Scientific Officer
43.	Sabina Yasmin, M.S. (Agriculture Economics)	Senior Scientific Officer
44.	Md. Humayun Kabir, M.S (Pathology) PhD fellow	Senior Scientific Officer
45.	Md. Amirul Hasan, M.S. (Medicine) PhD	Senior Scientific Officer
46.	Jobaida Shovona Khanam, M.S. (Animal Breeding & Genetics)	Senior Scientific Officer
47.	Md. Faizul Hossain Miraz, M.Sc. (Animal Science)	Senior Scientific Officer
48.	Dr. A.S.M. Ashab Uddin, DVM, M.S.C (Microbiology)	Senior Scientific Officer
49.	Sabiha Sultana, PhD (Poultry Nutrition of Physology)	Senior Scientific Officer
50.	Md. Ataul Gani Rabbani, B.Sc. AH. (Hon's) PhD fellow	Senior Scientific Officer
51.	Nure Hasni Disha, M.S. (Animal Breeding & Genetics)	Senior Scientific Officer
52.	Md. Redoan Akond Sumon, M.S. (Animal Nutrition)	Senior Scientific Officer
53.	Sonia Akter, M.S. (Pathology)	Senior Scientific Officer
54.	Md. Zulfekar Ali, M.S. (Microbiology)	Senior Scientific Officer
55.	Md. Habibur Rahaman, DVM	Senior Scientific Officer
56.	Md. Obayed Al Rahman, M.S. (Poultry Science)	Scientific Officer
57.	Ummeya Shiha Alam	Scientific Officer
58.	Md. Shamim Hasan	Scientific Officer
59.	Md. Al-Mamun, M.A (Information Science & Library Management)	Librarian
60.	Md. Zahidul Islam M.S.S (Public Administration)	Publication Officer
61.	Devjyoti Ghosh M.S.S (Journalism and media studies)	Information Officer

No.	Name	Designation
62.	Md. Mahmudul Hasan Pasha	Scientific Officer
63.	Md. Ashraful Islam	Scientific Officer
64.	Shahana Nazneen	Scientific Officer
65.	Md. Tasmirul Islam	Scientific Officer
66.	Md. Ariful Islam	Scientific Officer
67.	Md. Hafizur Rahman	Scientific Officer
68.	Ayesha Shiddika Afsana	Scientific Officer
69.	Enam Ahmed	Scientific Officer
70.	Shahanaj Ferdousi Shejuty	Scientific Officer
71.	Manik Miah	Scientific Officer
72.	Sadia Afrin	Scientific Officer
73.	Md. Mostain Billah	Scientific Officer
74.	Abu Haris Miah	Scientific Officer
75.	Md. Asief Hossain Zihadi	Scientific Officer
76.	Farzana Yasmin	Scientific Officer
77.	Mohammad Mahbub Hasan	Scientific Officer
78.	Mizanur Rahman Khan	Scientific Officer
79.	Khairun Nahar Shithi	Scientific Officer
80.	Mst. Nazia Akter	Scientific Officer
81.	Sukumar Roy	Scientific Officer
82.	Dipu Roy	Scientific Officer
83.	Aminul Islam	Scientific Officer
84.	Bijoy Barua	Scientific Officer
85.	Syidul Islam	Scientific Officer
86.	Zamila Bueaza Bupasha	Scientific Officer
87.	Mizanur Rahman Manu	Scientific Officer
88.	Sadia Binte Sadrul	Scientific Officer
89.	Al-Amin Hossain	Scientific Officer
90.	Anowar Hosen	Scientific Officer
91.	Sonia Sultana	Scientific Officer
92.	Sharmin Akter Tule	Scientific Officer
93.	Dipa Das	Scientific Officer

No.	Name	Designation
94.	Khadiza-Tut-Tahira	Scientific Officer
95.	Lipi Rani Sarker	Scientific Officer
96.	Eshtiak Ahamed Pehan	Scientific Officer
97.	Obydul Islam	Scientific Officer
98.	Md. Hossen Ali	Scientific Officer
99.	Md. Tareq Hossain	Scientific Officer
100.	Shahrina Akter	Scientific Officer
101.	SM Soheb Ahmed	Scientific Officer
102.	Homayra Siddika	Scientific Officer
103.	Md. Razibul Hasan	Scientific Officer
104.	Mohammad Nizamul Hoque Touhid	Scientific Officer
105.	Md. Nurul Haque	Scientific Officer
106.	Mst. Mamata Akter	Scientific Officer
107.	Md. Nazmul Huda	Scientific Officer
108.	Md. Rasel Miah	Scientific Officer
109.	Monjura Mojib Bonet	Scientific Officer
110.	Md. Iftakher Alam Sarker	Scientific Officer
111.	Md. Tarikul Islam	Scientific Officer
112.	Nushrat Nourin Lisa	Scientific Officer
113.	Kamrun Naher Papry	Scientific Officer
114.	Ahnaf Anjum Dara	Scientific Officer
115.	Sharmin Sultana	Scientific Officer
116.	Most. Umme Saleheen Ety	Scientific Officer
117.	Sifat Hossain Joya	Scientific Officer
118.	Md. Shafiqul Alam Mondol, Dip-in-Eng. (Electric)	Sub Asst. Engineer (Electronics)
119.	Md. Ahsan Habib, M.Com	Security Officer
120.	Md. Farid Miah, M.B.S.	Procurement Officer
121.	Md. Eaqub Ali	Sub Asst. Engineer (Civil)
122.	Md. Imran Hossain	Photographer