Research Program (2025-26)

Farm Machinery and Postharvest Technology Division, Gazipur-1701

Programme area	**:**	**Farm Mechanization and Postharvest Technology**
1 Project Title	***:***	***Development of Agricultural Machines***
1.1 Experiment Title	***:***	***Evaluating and modifying of BRRI developed machines***
Objectives	:	• To verify the quality of BRRI machines • To identify the functional problems of farm machines • To improve the performance of farm machines
Location (s)	:	FMPHT div. res. workshop and BRRI farm
Status of the Experiment	:	❖ On-going (Continuous) Starting Date: 01-07-1998 Expected Completion Date: Continuous
Plan of activities to achieve the objective (s)	:	❖ BRRI power weeder, reaper, and head feed thresher will be modified ❖ A laboratory test will be done at the BRRI workshop ❖ Field tests of BRRI machines (Transplanter, USG/Prilled urea applicator, weeder, mini combine harvester, reaper, etc.) will be conducted to identify the functional problems, ❖ After that, rectify or modify the particular machine to improve its performance.
Expected output	:	• The performance of the machine will be improved
1.2 Experiment Title	***:***	***Design and development of walking type power operated rice transplanter***
Name of Investigator (s)	:	PI: MAH CI: AKMS, MMI, HP, SI
Objectives	:	• To design and develop a power-operated rice transplanter • To test the performance of the developed rice transplanter
Location (s)	:	Gazipur, Mymensingh, Netrokona, Habigonj, Rangpur and Comilla
Status of the Experiment	:	❖ On-going (Continuous) Starting Date: 01-07-2019 Expected Completion Date: Continuous
Plan of activities to achieve the objective (s)	:	❖ Different components/parts of the walking-type transplanter will be studied in laboratory conditions. These parts will be used as reference parts to develop the rice transplanter ❖ The power transmission system will be studied for designing different components. ❖ Engineering drawing will be done with the help of three-dimensional AutoCAD tools to develop the mechanical rice transplanter. ❖ Based on the design, fabrication works will be done in the BRRI research workshop ❖ The fabricated transplanter will be tested in the field and data to be collected. ❖ The mainframe with an engine, gearbox, propeller shaft, picker, handle with the operating lever, Picker with chain cover, Seedling rack, Seedling rack moveable channel, Wheel with chain box, Ordinary stand, Seedling tray slider, Additional rod of the seedling rack, Floating skid, Lever withstand, Spare seedling tray, Marker with furrow closer, Engine cover, seedling tray or mat will be fabricated and assembled.
Expected output	:	A walking type of power-operated rice transplanter will be introduced to the end-users

1.3 Experiment Title	***:***	***Performance evaluation of the laser land leveler with the conventional method***
Name of Investigator (s)	:	PI: MMR CI: AKMSI, SP, AUK
Objectives	:	• To evaluate the performance of laser land leveler and conventional systems • To find the feasibility of the laser land leveler in Bangladesh
Location (s)	:	All over Bangladesh
Status of the Experiment	:	❖ On-going (Continuous) Starting Date: 01-07-2023 Expected Completion Date: 30-06-2026
Plan of activities to achieve the objective (s)	:	❖ The present study will be carried out in the research farm of BRRI regional station in Sonagazi, Feni, during the Boro season to evaluate the performance of the laser land leveler with the existing system of leveling. A laser guided land leveler (LAZERLI TESVIYE, Model: 1.JNR. 250.CIFT) will be used for the study. The laser-controlled system consisted of (i) Tripod, (ii) Laser Transmitter, (iii) Laser Receiver, (iv) Control Box, (v) Hydraulic Pump, (vi) Drag Bucket. The wooden pegs, spirit level and measuring tape will be used for marking reference points, to ensure accurate leveling off the field, and to measure the distance between reference points.
Expected output	:	Laser land leveler operation will be well known, and use of laser leveler will be introduced.
1.4 Experiment Title	***:***	***Identification and fabrication of fast-moving spare parts of combine harvester and rice transplanter enhancing sustainable mechanization in Bangladesh***
Name of Investigator (s)	:	PI: MAH CI: SI, HP, MMS, SP, MMR
Objectives	:	• To list down the fast-moving spare parts of the different makes and models • To identify the strength and quality of the major parts • To take the initiative for the fabrication of the parts
Location (s)	:	BRRI, Gazipur, and Fermers' field
Status of the Experiment	:	❖ On-going (Continuous) Starting Date: 01-07-2023 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	❖ The following activities will be conducted under the proposed program. ❖ Machine model and brand selection ❖ Data collection from the machine and spare parts importers/companies ❖ Spare category: ❖ Maintenance spares ❖ Consumable spares ❖ Commercially viable numbers identification ❖ Shortlisting of the local manufacturers ❖ Sample product manufacturing ❖ Documentation ❖ Training of the local maintenance technicians and manufacturers
Expected output	:	The use of combine harvesters is rising steadily in the country. Now, farmers are given access to various makes and models of combine harvesters, but because spare parts frequently fail, their operation is often interrupted during the peak season. This study will enable the development of commercially viable parts for domestic production, identifying the fast-moving parts. Additionally, it would increase the

		number of local small business owners, lessen reliance on imports, and make the combine harvester viable and sustainable.
1.5 Experiment Title	:	***Design and development of self-propelled fertilizer deep placement applicator***
Name of Investigator (s)	:	PI: SP CI: MGKB, MAH, MKP, HP, MMR
Objectives	:	• To design, fabricate, and develop a power-operated fertilizer deep placement applicator using an existing developed manual applicator. • To compare with other fertilizer applicators.
Location (s)	:	BRRI, Gazipur, and Fermers' field
Status of the Experiment	:	❖ On-going (Continuous) Starting Date: 01-07-2023 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	❖ Engine, motor, battery, GI pipe, GI sheet, MS sheet, MS flat bar, and MS shaft will be procured from local markets. ❖ At first, engineering design will be done, and a prototype will be fabricated according to the design. ❖ The existing developed fertilizer applicator will be used as a baseline or reference model. ❖ Power will be incorporated into the developed manual fertilizer applicator with some modifications. ❖ The fabricated power fertilizer applicator will be tested in the field, and data will be collected. ❖ **Data to be collected during laboratory and research field test** ❖ Fertilizer dispensing rate (%) ❖ Deviation of dispensing rate from design rate (%) ❖ Uniformity of fertilizer dispensing (%) ❖ Depth of dispensing (cm) ❖ Covering performance (%) ❖ Field capacity (ha/h) at different soil conditions. ❖ Operators' opinion
Expected output	:	• Power-operated fertilizer applicator will be developed • Manually fertilizer deep placement difficulties will be solved. • Losses of fertilizer in different ways will be reduced. • Farmers can save time and costs for fertilizer deep placement with a power-operated fertilizer applicator.
1.6 Experiment Title	:	***Design and development of a single-row wetland power weeder***
Name of Investigator (s)	:	PI: SP CI: SI, HP, MMI, MMR, MMS, AUK
Objectives	:	• To design, fabricate, and develop a power-operated single-row weeder suitable for weeding both in a row-to-row and line-to-line of the lowland and upland fields (line and without line sowing). • To evaluate its performance in the different multi-crop fields. • To compare with other dry and wetland paddy weeders
Location (s)	:	BRRI, Gazipur, and Farmers' field
Status of the Experiment	:	❖ On-going (Continuous) Starting Date: 01-07-2023 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	❖ Engine, GI pipe, GI sheet, MS sheet, MS flat bar, MS shaft, MS flat bar, etc. will be collected from the local market ❖ Engineering design will be done, and a prototype will be fabricated according to the design. ❖ The fabricated weeder will be tested in the FMPHT divisional workshop, farmers' field, and data will be collected. **Data to be collected during laboratory and research field tests** ❖ Walking speed (km/h) ❖ Weeding efficiency (%) ❖ No plant damage

		❖ Field capacity (ha/h) at different soil conditions. ❖ Comparison with the BRRI weeder ❖ Operators' opinion
Expected output	:	• Power-operated single-row paddy weeder, as well as a multi-crop weeder, will be developed • Uprooting weeds from plant to plant will be done mechanically. • Extra labor for uprooting weeds from line to line of paddy fields will be reduced. • Farmers can save time and costs for weeding with power-operated machines.
1.7 Experiment Title	***:***	***Performance evaluation of BRRI whole feed combine harvester (model no.- BRRI WCH 2021) under different soil conditions, crop conditions, and seasons***
Name of Investigator (s)	:	PI: AUK CI: AKMSI, MDH, MKP, MMR, SP, MMS
Objectives	:	• To evaluate the performance of the BRRI combine harvester in respect of soil condition, crop condition, and seasons • To establish a relationship between the machine performance and the plough pan depth of the field • To compare the performance of the BRRI combine harvester with the traditional harvesting systems.
Location (s)	:	BRRI, Gazipur, and Fermers' field
Status of the Experiment	:	❖ On-going (Continuous) Starting Date: 01-07-2023 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	❖ Performance evaluation of the BRRI-developed whole feed Combine Harvester will be carried out during the harvesting period in the fields of BRRI regional stations (Sirajganj, Cumilla, and Gopalganj). ❖ Specific fuel consumption, field capacities (theoretical field capacity and effective field capacity), field efficiency, plough pan depth, harvesting losses, cost of operation, etc., will be studied for both machine harvesting and manual harvesting. ❖ Cost comparisons will be calculated for machine harvesting compared to manual harvesting, and a plot will be selected to determine the harvester's operational speed, field capacity (ha/h), labor requirements, fuel consumption, and grain losses due to the combine harvester. ❖ The area of the plot will be measured with tape. Also, three small areas in the plot were randomly selected to determine shattering loss. Harvested these plots manually and counted the total spikes to estimate the total yield. ❖ After harvesting, three plots randomly collected scattered spikes from selected areas for both manual and combine harvesting.
Expected output	:	The performance of the BRRI-developed combine harvester will be known, and its suitability in various field conditions will be assessed. All the performance data can be easily compared with the imported combine harvester through data analysis by storing the data.
1.8 Experiment Title (New)	***:***	***Improvement of a BRRI Head Feed Combine Harvester for mechanized rice cultivation (BRRI HCH2023)***
Name of Investigator (s)	:	PI: AKMSI CI: MGKB, MKP, MMI, MMA, MAA, MMH
Objectives	:	• To design a head feed combine harvester • To manufacture the designed combine harvester prototype To evaluate the field performance of the developed combine harvester.
Location (s)	:	BRRI HQ and RS
Status of the Experiment	:	❖ On-going (Continuous) Starting Date: 01-07-2024 Expected Completion Date: 30-06-2027

Plan of activities to achieve the objective (s)	:	❖ The design of the head feed combine harvester was done with the help of AutoCAD engineering tools (software). The prototype of the machine will be fabricated by Alim Industries Ltd, Sylhet, in collaboration with other local agricultural machinery manufacturers, according to the design.
Expected output	:	This research is feasible to design, develop, and fabricate a combine harvester to solve farmers' harvesting problems in Bangladesh. All efforts should be made to ensure that the cost of production is significantly reduced, and the combine harvester is readily accessible to small-scale traders and farmers across the country. Harvesting paddy from fragmented farmland in Bangladesh is more efficient and has a comparative advantage over imported combine harvesters. It would be a tremendous success in Bangladesh to fabricate the combine harvester machine using the capabilities of local agricultural machinery manufacturers and the design and technology of BRRI.
1.9 Experiment Title (New)	***:***	***Performance evaluation of the BRRI auto seed sower machine for raising mat-type seedlings***
Name of Investigator (s)	:	PI: AUK CI: AKMSI, SP, MMI, MS
Objectives	:	• To assess the operational performance of the BRRI Auto Seed Sower Machine • To compare the performance with the imported Power Seed Sower Machine, raising seedlings for a mechanical rice transplanter
Location (s)	:	BRRI, Gazipur, and Farmers' field
Status of the Experiment	:	❖ On-going (Continuous) Starting Date: 2024 Expected Completion Date: 2027
Plan of activities to achieve the objective (s)	:	❖ The BRRI developed an automatic seed sower machine that was designed and fabricated using AutoCAD. Jigs, fixtures, and molds for the main basement, soil hopper base, seed hopper base, water tank base, and motor basement were developed for quick replication. ❖ Adjusting the lever achieved calibration for different soil types and various sizes of paddy seeds. The prototype's performance was tested in the FMPHT divisional research workshop at Uttaron Engineering, Dinajpur, as well as in farmers' fields. This machine was developed under the BRRI SFMRA project.
Expected output	:	❖ The BRRI auto seed sower machine prototype performed well in tests conducted at research workshops and farmers' fields, yielding satisfactory results. ❖ This technology is viewed as a time-saving solution for efficiently preparing seedling trays for mechanical transplanting, potentially reducing reliance on manual labor.
1.10 Experiment Title (New)	***:***	***Performance evaluation of BRRI Head Feed Combine Harvester (Model-BRRI HCH2023)***
Name of Investigator (s)	:	PI: AUK CI: AKMSI, SP, MMI, MS
Objectives	:	• To assess the field performance of the developed head feed combine harvester • To compare the performance with imported combine Harvester
Location (s)	:	BRRI, Gazipur, and Fermers' field
Status of the Experiment	:	❖ On-going (Continuous) Starting Date: 01-07-2024 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	❖ Study location and crop Conditions: The BRRI head feed combine harvester performance will be done during Boro 2024 season at the farmers' field. ❖ elected combine harvester

		❖ Paddy harvesting using BRRI Combine harvester ❖ Performance representing parameters ❖ Field Capacity ❖ Determination of mechanical harvesting losses ❖ Time distribution of combined harvester operation
Expected output	:	The performance of BRRI head feed combine harvesters compared with imported combine harvesters under different soil conditions and crop conditions and harvesting a variety of grain crops. The developed BRRI head feed combine harvester would be able to meet the domestic demand for agricultural machinery, reduce import dependence, and export it abroad with more government policy support.
1.11 Experiment Title (New)	***:***	***Improvement of a BRRI whole feed Combine Harvester (Model BRRI WCH2021)***
Name of Investigator (s)	:	PI: AKMSI CI: AUK, MKP
Objectives	:	• To identify areas for improvement in the BRRI Whole Feed Combine Harvester (Model BRRI WCH2021) • To design and fabricate a BRRI whole feed combine harvester based on the performance, repair, and maintenance facility • To evaluate the performance test of the developed combine harvester • To compare the performance with the imported combine Harvester
Location (s)	:	Alim Industries Ltd, Sylhet
Status of the Experiment	:	❖ On-going (Continuous) Starting Date: 01-07-2024 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	❖ The whole feed mini combine harvester was designed with the help of AutoCAD engineering tools (software). ❖ Alim Industries Ltd, Sylhet, will fabricate the machine prototype according to the design with the help of other local agricultural machinery manufacturers.
Expected output	:	❖ This research shows that it is possible to design, develop, and fabricate a combine harvester to solve farmers' harvesting problems in Bangladesh. ❖ All attempts should be taken to ensure the cost of production is significantly reduced, and the combine harvester is readily accessible to small-scale traders and farmers of the country. ❖ Harvesting paddy from fragmented farmland in Bangladesh is more efficient and has a comparative advantage over imported combine harvesters. ❖ Fabricating the combine harvester machine using the capabilities of local agricultural machinery manufacturers and BRRI's design and technology would be a tremendous success in Bangladesh.
1.12 Experiment Title (New)	***:***	***Design, Development, and Fabrication of a BRRI ride-on rice transplanter for mechanical rice planting***
Name of Investigator (s)	:	PI: AKMSI CI: AUK, MKP
Objectives	:	• To design and develop of BRRI ride-on Rice transplanter • To evaluate the performance test of the developed Rice transplanter • To progress mechanized rice transplanting direct seedlings, including direct and precision rice seedling technologies
Location (s)	:	BRRI, Gazipur
Status of the Experiment	:	❖ On-going (Continuous) Starting Date: 01-07-2024 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	❖ Conduct a thorough analysis of the requirements and specifications for the ride-on type rice transplanter, considering factors such as field conditions, terrain, planting density, and operational efficiency. ❖ Gather feedback from farmers, agricultural experts, and stakeholders to understand their needs and preferences. Based on the identified

		requirements and constraints, generate initial design concepts. ❖ Explore different design alternatives and evaluate their feasibility, considering factors such as ease of operation, ergonomics, fuel efficiency, and maintenance requirements. ❖ Develop manufacturing processes for each part of the transplanter. Based on the detailed design, fabricate a prototype of the ride-on type rice transplanter. Conduct rigorous testing and validation of the prototype under controlled laboratory conditions to assess its functionality, durability, and performance. ❖ Conduct extensive field testing of the prototype in real-world agricultural settings, including various soil types, slopes, and weather conditions.
Expected output	:	Continued research in precision technology for rice transplanting remains essential for enhancing efficiency and effectiveness in rice cultivation. The advancement of rice transplanters offers several key benefits. The developed rice transplanter i) saves labour cost, timeliness of transplanting, and water savings ii) The seedlings are planted at uniform spacing and sufficient depth iii) Increase in productivity compared to hand transplanting.
1.13 Experiment Title (New)	***:***	***Harvesting Performance and grain losses: Impact of paddy harvester type, speed, and crop density***
Name of Investigator (s)	:	PI: MAH CI: BCN, SP, AUK, JN
Objectives	:	• To assess the harvesting performance of different paddy harvester types under various operational speeds and crop density conditions. • To measure grain losses associated with each harvester type and operational setting. • To identify the optimal operational parameters for different crop densities to minimize losses and enhance efficiency.
Location (s)	:	Different regions of Bangladesh based on BRRI R/S
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2028
Plan of activities to achieve the objective (s)	:	**Experimental Design:** • Three factors factorial design will be applied to conduct the study. • Selection of different types of combine harvesters. • Testing at different operational speeds (low, medium, and high) in fields with varying crop densities (low, medium, and high). • Replicated trials in different regions to account for environmental variations. • Other parameters will try to maintain the same for the study. **Data Collection:** • Harvesting efficiency (rate of area coverage, fuel consumption, specific fuel consumption, and field capacity). • Grain losses are categorized as pre-harvest losses, header losses, cylinder losses, separation losses, and total losses. • Crop density measurements and lodging percentage assessment. **Data Analysis:** • Statistical analysis to compare performance and losses across harvester types, speeds, and crop densities. • Regression analysis to determine the relationship between operational parameters and grain losses. • Economic assessment of cost-effectiveness for each harvester type and speed combination.
Expected output	:	• Identification of the most efficient harvester type and operational speed for different crop densities. • Recommendations to optimize mechanized harvesting strategies in Bangladesh.
1.14 Experiment Title	***:***	***Design and Development of an Automated Rodent Trap for Reducing Post-Harvest Losses of Rice***

Name of Investigator (s)	:	PI: MMA CI: BCN, SP, GKB, HR, MMH
Objectives	:	• Design and development of an automated rodent trap • Performance evaluation of the fabricated trap
Location (s)	:	FMPHT division
Status of the Experiment	:	❖ On-going (Continuous) Starting Date: 01-07-2024 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	❖ The study will be conducted at the Farm Machinery and Post Harvest Technology (FMPHT) Division, BRRI, Gazipur. The layout of the automated mouse trap will be designed in AutoCAD Engineering Drawing tools. The following materials will be used to provide the physical shape of the automated mouse trap: ❖ Motor (6 V DC) ❖ PIR Sensor ❖ Circuit ❖ LED light ❖ Lithium battery (3.7V, 1000mAh) etc.
Expected output	:	• Eco friendly mouse trap will be developed • Post-harvest loss will be reduced
1.15 Experiment Title (New)	***:***	***Performance Evaluation of the Yanmar Intelligent (Model: 6114R) Combine Harvester***
Name of Investigator (s)	:	PI: MMR CI: MDH, BCN, MKM, SP
Objectives	:	• To evaluate the performance efficiency of the combine harvester. • To assess the yield monitoring and yield loss in real time.
Location (s)	:	FMPHT division and Farmer's fields
Status of the Experiment	:	❖ On-going (Continuous) Starting Date: 01-07-2024 Expected Completion Date: 30-06-2026
Plan of activities to achieve the objective (s)	:	❖ **Field Trials:** Conduct field trials to evaluate the combine harvester's performance. ❖ **Laboratory Analysis:** Perform laboratory analysis on harvested grain samples to assess quality parameters such as moisture content, damage levels, and nutritional value. ❖ **User Experience Assessment:** Gather feedback from operators and farmers through structured interviews and surveys to evaluate the ease of operation, maintenance, and overall user satisfaction. ❖ **Statistical Analysis:** Employ statistical methods to analyze the collected data and derive meaningful insights regarding the combine harvester's performance across various parameters.
Expected output	:	Performance evaluation of the Yanmar Intelligent (Model: 6114R) Combine Harvester will be carried out.
1.16 Experiment Title (New)	***:***	***Design and development of a rice straw-baler***
Name of Investigator (s)	:	PI : BCN CI: SP, MDH, MGKB
Objectives	:	• To design and develop a prototype of a straw baler • To evaluate the performance of the developed straw baler • To assess the straw baler's economic viability
Location (s)	:	FMPHT workshop, BRRI farm Gazipur/ Fulbari, Dinajpur/other locations
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2028
Plan of activities to achieve the	:	The following materials and equipment will be used in the design and

objective (s)		development of the straw baler: ▪ **Structural Components:** Mild steel, angle bars, and galvanized sheets for the mainframe and housing. ▪ **Baling Mechanism:** Rollers, compression chamber, and binding system for forming compact straw bales. ▪ **Power Source:** Small diesel/petrol engine or tractor PTO (Power Take-Off) for operating the baler. ▪ **Transmission System:** Chain, sprocket, belt, and pulley mechanism to transfer power to the baling components. ▪ **Rubber wheels and chassis** **Data to be collected** **Baler Performance Data** ▪ Bale dimensions (length × width × height, cm) ▪ Bale weight (kg) ▪ Baling capacity (kg/hour or bales/hour) ▪ Bale density (kg/m³) ▪ Compression ratio (%) **Operational Efficiency Data** ▪ Fuel or power consumption (L/hour or kWh/hour) ▪ Time required per bale (minutes/bale) ▪ Labor requirement (number of workers and time per hectare) ▪ Field capacity (ha/hour) **Economic Data** ▪ Production cost of the baler (BDT/unit) ▪ Operational cost (BDT/hour or BDT/bale) ▪ Cost-benefit analysis (profit/loss per hectare or bale) ▪ Market value of baled straw (BDT/kg or BDT/bale)
Expected output	:	A cost-effective and efficient straw baler will be available
1.17 Experiment Title (New)	***:***	***Effects of Urea Fertilizer Management on GHG Emission and Rice Yield Using BRRI Prilled Urea Applicator***
Name of Investigator (s)	:	PI: MKM CI: MM Haque, MMR
Objectives	:	• To evaluate the impacts of different fertilizer application methods on greenhouse gas (GHG) emissions. • To assess the yield performance of BRRI Dhan 89 under varied fertilizer treatments.
Location (s)	:	FMPHT division
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2028
Plan of activities to achieve the objective (s)	:	**Experimental Design** • Design Type: Randomized Complete Block Design (RCBD) • Replications: 3 • Crop Variety: BRRI Dhan 89 **Treatments** 1. Control: No urea fertilizer applied. 2. Hand Broadcasting: Urea applied 3 times, with a total of 40 kg per bigha. 3. Prilled Urea Applicator: Single urea application, 28 kg per bigha (30% reduced application compared to hand broadcasting). **Plot Layout** • Plots will be arranged randomly with three replications per treatment to ensure reliable statistical analysis. • Each plot size and field preparation will follow standardized agronomic practices for BRRI Dhan 89 cultivation.

		Data Collection • Agronomic Data: o Days to Sowing (D/S) o Days to Transplanting (D/T) o Yield per plot (kg) o Biomass accumulation • Environmental Data: o Greenhouse gas emissions, specifically nitrous oxide (N2O) flux measurements. **GHG Monitoring** • Gas samples will be collected using static chambers from each plot and analyzed in a laboratory to measure N2O emissions. Data will be recorded at regular intervals post-fertilizer application.
Expected output	:	✓ Identification of the most efficient fertilizer application method to reduce GHG emissions. ✓ Enhanced yield performance of BRRI Dhan 89 under optimized fertilizer management. ✓ Contribution to sustainable agricultural practices through the adoption of Prilled Urea Applicator technology.
1.18 Experiment Title (New)	***:***	***Improvement of BRRI Prilled Urea Applicator***
Name of Investigator (s)	:	PI: MKM CI: MMR
Objectives	:	• To improve the design of the BRRI Prilled Urea Applicator for increased field efficiency. • To redesign the metering device and controlling system for better accuracy and ease of operation. • To modify the skid design to require less power and be easier to manufacture. • To evaluate the improved applicator under field conditions and compare its performance with the existing model.
Location (s)	:	FMPHT division
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2028
Plan of activities to achieve the objective (s)	:	• Review of Existing Design: Analyze the current BRRI Prilled Urea Applicator's performance, identifying key limitations through field observations and farmer feedback. • Design Modifications: Propose and implement design improvements, including nozzle adjustments, metering mechanisms, controlling systems, and ergonomic features. • Skid Enhancement: Develop a new skid design that requires less power to push and is easier to fabricate. • Prototype Development: Fabricate an improved version incorporating the modifications. • Field Trials: Test the improved applicator in multiple rice-growing regions to evaluate efficiency, uniformity, and ease of use. • Comparative Analysis: Assess the performance of the improved applicator against the current model in terms of nitrogen use efficiency, yield impact, and labor requirements. • Final Adjustments and Recommendations: Refine the design based on field trial results and farmer input.
Expected output	:	• A more efficient and user-friendly Prilled Urea Applicator. • Improved nitrogen use efficiency leading to better rice yields. • Reduced labor and time required for urea application.
1.19 Experiment Title (New)	***:***	***Design and development of a high-capacity head feed thresher***
Name of Investigator (s)	:	PI: SP

		CI: MDH, BCN, MGKB, MMR, MMA
Objectives	:	• To develop and fabricate a high-capacity head feed paddy thresher • To evaluate the performance of the developed thresher
Location (s)	:	FMPHT workshop and Agricultural machinery manufacturers (Dinajpur/Netrokona/Choyadanga/ other places)
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2028
Plan of activities to achieve the objective (s)	:	The study will be conducted at the Farm Machinery and Postharvest Technology (FMPHT) Division, BRRI, Gazipur and Fulbari, Dinajpur district. The design, development, and fabrication will be done in the BRRI research workshop/Arfat Engineering at Fulbari, Dinajpur, under a public-private partnership (PPP) to develop a high-capacity head feed thresher. AutoCAD/SolidWorks engineering tools will be used for design. **Prototype development process** ***a. Prototype Development:*** i. Collaborate with local agricultural machinery manufacturers to design and fabricate a high-capacity head feed paddy thresher prototype. ii. Incorporate features addressing challenges Bangladeshi farmers face, such as variations in paddy varieties and field conditions. ***b. Performance Evaluation in Bangladesh Conditions:*** i. Conduct extensive field trials in different regions of Bangladesh to assess the prototype's efficiency and adaptability. ii. Collect feedback from farmers on the usability and practicality of the modified thresher. ***c. Economic Feasibility Assessment:*** i. Analyze the cost of production, maintenance, and potential economic benefits for Bangladeshi farmers. ii. Assess the modified thresher's affordability and return on investment in the local context. **Design considerations** ❖ The high-capacity head feed paddy thresher should be optimized for Bangladesh's diverse rice varieties (Aus, Aman, Boro) and field conditions, ensuring adaptability to moisture variations and minimizing grain loss. ❖ The design should maximize threshing efficiency while preserving unbroken straws, essential for cattle feed and household fuel in Bangladesh. ❖ Key mechanical improvements should include an optimized drum configuration, efficient feeding mechanisms, durable materials, and a user-friendly operation system. ❖ The machine must balance high performance with economic feasibility, reducing fuel consumption, lowering labor requirements, and ensuring affordability for smallholder farmers. **Data to be collected:** To evaluate the performance and efficiency of the high-capacity head-feed thresher, the following data will be collected: **Machine Performance Parameters** ➢ Threshing capacity (kg/h) – Amount of paddy processed per hour ➢ Threshing efficiency (%) – (Grain threshed / Total grain) × 100

		➢ Cleaning efficiency (%) – (Clean grain / Total threshed grain) × 100 ➢ Grain output rate (kg/h) – Amount of clean grain collected per hour ➢ Unthreshed grain loss (%) – (Unthreshed grain / Total grain) × 100 ➢ Straw length after threshing (cm) – Average length of straw after processing ➢ Fuel/power consumption (L/h or kWh) – Fuel or electricity used per hour **Crop Parameters** ➢ The moisture content of paddy (%) – Measured before and after threshing ➢ Straw moisture content (%) – Water content in straw before threshing ➢ Grain-straw ratio – Ratio of grains to straw in the harvested crop **Economic Parameters** ➢ Labor requirement (person-hours/ton) ➢ Operational cost (BDT/kg or BDT/h)
Expected output	:	i. A high-capacity, cost-effective head feed paddy thresher prototype will be developed. ii. The thresher efficiency and adaptability will be improved in diverse regions of Bangladesh.
1.20 Experiment Title (New)	**:**	***Performance evaluation of the BRRI-developed rice transplanter***
Name of Investigator (s)	:	PI: AUK CI: AKMSI, MSK, JN
Objectives	:	• To assess the performance of the BRRI-developed walking and riding-type rice transplanter • To compare the performance of the imported rice transplanter.
Location (s)	:	All over the country
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	The developed 6-row rice transplanter will be tested in the research workshop, and its functional trials will be conducted in the farmers' fields at Rajshahi and Bogura. A rice transplanter is used to increase the speed of the transplanting operation and properly place paddy seedlings in rows. It will be developed for rice (Oryza sativa) to find a possible solution to the problems associated with rice transplanting. The machine will be developed considering various factors affecting the performance of the transplanter. The experimental field will be plowed, and the weeds will be removed. Water will be applied to the field to create a steady-state condition for the transplanting operation, and the water will be drained out 24 hours before transplanting. **Data to be collected:** • Line to line and plant-to-plant spacing • Seedling height and density • Seedling depth • Machine adjustment • Missing hills • Floating hills • Damaged hills • Fuel Consumption • Field capacity

		• Field efficiency
Expected output	:	• Due to its higher yield, the transplanting method is expected to become more popular among farmers for the sustainable future of rice farming. • Coordinating initiatives by implementing appropriate guidelines and collaborative efforts between public and private sector entities is imperative to advance agricultural mechanization effectively.
1.21 Experiment Title (New)	***:***	***Moisture content effect on rice at threshing and cleaning of combine harvester***
Name of Investigator (s)	:	PI: JN CI: MDH, MGKB, MAH, BCN, SP, MMR
Objectives	:	• To assess the field performance of combine harvester at varying moisture levels • To observe the threshing and cleaning efficiency of the combine harvester at varying moisture levels • To quantify grain losses and breakage at varying moisture levels.
Location (s)	:	FMPHT division
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2028
Plan of activities to achieve the objective (s)	:	**Study Area and Rice Variety** • The study will be conducted at FMPHT Division, BRRI, Gazipur, Bangladesh. • Focus will be on widely cultivated rice varieties with different moisture content characteristics. **Data Collection and Experimental Design** **Effect of Moisture Content on Rice Harvesting** • Moisture content of rice grains will be measured at different harvesting times (18%, 20%, 22%, and 25%). • Grain loss, breakage, and harvesting efficiency will be analyzed. **Moisture Content vs Time** • The impact of time delays on moisture content reduction and its influence on harvesting efficiency will be studied. **Moisture Content vs Machine Operation Problem** • How different moisture levels cause machine clogging, inefficiencies, and increased fuel consumption will be evaluated. **Moisture Content vs Machine Efficiency** • Machine performance at different moisture content levels will be recorded, focusing on fuel consumption, operational time, and yield loss. **Effect of Moisture Content on Threshing** • The study will examine how moisture levels affect threshing efficiency, grain separation, and threshing losses. **Moisture Content vs Paddy Breakage** • The relationship between moisture content and grain damage during mechanical and manual threshing will be analyzed. **Moisture Content vs Cleaning Problem** • The impact of moisture content on cleaning efficiency and grain purity post-threshing will be studied. **Moisture Content vs Efficiency of the Machine** • Threshing machine performance at different moisture levels will be recorded. **Effect of Moisture Content on Thresher Cylinder Speed** • The correlation between moisture content and optimal cylinder speed to minimize grain damage will be determined. **Effect of Moisture Content on Parboiling**

		• The effect of moisture content on hydration, gelatinization, and final rice quality during parboiling will be investigated. **The Effect of Moisture Content of Rice on Drying** • Drying performance for different moisture content levels using sun drying and mechanical drying will be compared. **Effect of Moisture Content on Milling** • Milling yield, head rice recovery, and grain breakage at varying moisture levels will be assessed. **Effect of Moisture Content on Seed Storage and Germination** • The impact of moisture content on seed viability, fungal growth, and germination rate will be examined over different storage durations.
Expected output	:	• Identifying optimal moisture content levels for harvesting, threshing, drying, and milling. • Reduced grain losses through improved moisture management strategies. • Enhanced milling yield and storage quality for long-term food security.
1.22 Experiment Title (New)	***:***	***Development of an improved multi-crop winnower***
Name of Investigator (s)	:	PI: MSK CI: AKMSI, MDH, MGKB, MAH, BCN, SP, JN
Objectives	:	• To develop an improved multi-crop winnower • To evaluate the performance of the developed multi-crop winnower
Location (s)	:	FMPHT division
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2028
Plan of activities to achieve the objective (s)	:	Developing a power-operated multi-crop winnower involves fabricating prototypes, testing them, and optimizing their performance based on field trials. Key performance indicators include winnowing efficiency (%), throughput capacity (kg/hr), and power consumption (kWh). The economic viability of the machine is also assessed through cost-benefit analysis, labor savings, and return on investment for farmers. The design and development process focuses on utilizing locally available materials and integrating compact, affordable, and compatible technology. **Materials** • Structural Components: Mild steel, sheet metal for the mainframe. • Sieving Mechanism: Multiple sieves with different mesh sizes to separate grains efficiently • Transmission System: Belt and pulley mechanism for power distribution. • Power Source: Electric motor **Design considerations** Crop Versatility: The winnower should be adaptable to different crops like rice, wheat, and maize Winnowing Efficiency: Should effectively separate grains from chaff, husk, dust, and other impurities. Airflow and Fan Design: Energy-efficient fan operation to reduce power consumption. Sieving Mechanism: Multiple sieves with different mesh sizes to separate grains efficiently. Power Source and Energy Efficiency: Low power consumption design for cost-effectiveness. Cost and Affordability: Should be affordable for small and medium-scale farmers. Machine development will be conducted in the FMPHT divisional

		workshop.
Expected output	:	A cost-effective, improved multi-crop winnower will be developed.
1.23 Experiment Title (New)	***:***	***Design and development of a boat-type hydro-tiller***
Name of Investigator (s)	:	PI: MAfH CI: MMA
Objectives	:	• To design and develop a boat-type hydro-tiller • To evaluate the performance of the developed boat type hydro-tiller
Location (s)	:	FMPHT division
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2028
Plan of activities to achieve the objective (s)	:	
Expected output	:	
2 Project Title	**:**	**Milling and Processing Technology**
Project Objectives	:	• To reduce loss, improve quality, and add value to the farm products
2.1 Experiment Title	***:***	***Design and development of a solar dryer***
Name of Investigator (s)	:	PI: SP CI: MDH, BCN, MGKB, BKB
Objectives	:	• To design, fabricate, and develop a solar dryer • To compare with the traditional sun drying of paddy
Location (s)	:	FMPHT Division Milling Laboratory
Status of the Experiment	:	❖ On-going (continuous) Starting Date: 01-07-2022 Expected Completion Date: 30-06-2026
Plan of activities to achieve the objective (s)	:	❖ GI pipe, GI sheet, MS sheet, MS flat bar, MS shaft, Glass, Solar collector, blower/fan, Wooden bar, etc,. will be collected from the local market ❖ Engineering design will be done, and a prototype will be fabricated according to the design. ❖ The fabricated dryer will be tested in the FMPHT divisional workshop, and data will be collected.
Expected output	:	A new solar dryer will be available for grain drying.
2.2 Experiment Title	***:***	***Design and development of a compact rice mill***
Name of Investigator (s)	:	PI: MGKB CI: AKMSI, MDH
Objectives	:	• To design and fabricate a compact rice mill • To evaluate the performance of the fabricated rice mill
Location (s)	:	FMPHT Division Milling Laboratory
Status of the Experiment	:	❖ On-going (continuous) Starting Date: 01-07-2022 Expected Completion Date: 30-06-2026
Plan of activities to achieve the objective (s)	:	❖ Two 15 cm rubber rolls will be set for de-husking, and one husk aspirator will be set to collect the husk ❖ Below the de-husker 15 cm diameter and 60 cm length stone polisher will be used for polishing brown rice, and one blower will be used to collect bran ❖ Below the polisher, one sieve will be set for grading rice. ❖ A 22 kW 3 Phase motor will be set up in the base of the compact rice mill that will operate the de-husker, polisher, and sieve through the pulley and shaft **Materials** ❖ 22 kW motor

		❖ 15 cm rubber roll ❖ 15cm dia. and 60 cm length stone polisher ❖ Blower, husk aspirator ❖ Angle bar, flat bar, nut bolt, pulley, shaft, etc.
Expected output	:	A compact rice mill will be developed and introduced to the end-users
2.3 Experiment Title	***:***	***Design and development of a mini rice mill for homestead-level use.***
Name of Investigator (s)	:	PI: MAH CI: GKB, HP, SP, AUK
Objectives	:	• To design and develop a mini rice mill suitable for individual households • To evaluate the milling performance using different rice verities under different conditions • To analyze the cost of milling and the pay-back period.
Location (s)	:	FMPHT Division Milling Laboratory
Status of the Experiment	:	❖ On-going (continuous) Starting Date: 01-07-2023 Expected Completion Date: 30-06-2026
Plan of activities to achieve the objective (s)	:	❖ Design, fabrication, evaluation, and improvement of the mini rice mill will be part of the proposed program. Standard engineering procedures will be followed to design the size, type, and number of belts, sheave size, take-up allowance for the idler sheave, power transmission mechanism, and other relevant components. **Fabrication** ❖ Prototypes will be fabricated in the FMPHT divisional research workshop based on the design. The existing workshop facility will be used to fabricate all components. **Data to be collected during laboratory and research field tests** ❖ Total weight and weight balance of the developed mill, ❖ Milling performance for different varieties under different conditions ❖ Cost analysis and pay-back period of the mill ❖ Load-bearing capacity under different feeding rates
Expected output	:	A suitable mini rice mill will be available at the household level.
2.4 Experiment Title	***:***	***Design, development, and fabrication of a recirculating-type smart dryer for drying paddy***
Name of Investigator (s)	:	PI: AKMSI CI: MAfH, AUK, MKP
Objectives	:	• To design and develop a recirculating-type smart dryer tailored specifically for paddy drying applications. • To implement advanced sensing and control technologies to create a smart drying system. • To conduct comprehensive testing and validation of the smart dryer prototype to evaluate its performance. • To assess the economic feasibility and potential scalability of the smart dryer technology for adoption in small to medium-scale rice processing facilities.
Location (s)	:	FMPHT division
Status of the Experiment	:	❖ On-going (continuous) Starting Date: 01-07-2024 Expected Completion Date: 3-06-2027
Plan of activities to achieve the objective (s)	:	❖ The experimental recirculating type smart dryer is being built to optimize dryer performance, particularly regarding specific energy consumption. However, various factors affect drying economics, such as drying duration, paddy quality, and weather. ❖ It includes an electric heating unit, hot air conveying pipeline, air supply system, and data acquisition unit. The study will vary drying air temperature (45 and 50°C, mass flow rate, grain moisture

		content, air temperature, and humidity.
Expected output	:	This research could include a functional prototype of the smart dryer, detailed technical documentation for fabrication and operation, implementation of advanced sensing and control technologies, integration of energy-efficient features, comprehensive performance validation, assessment of economic feasibility, and dissemination of findings to promote adoption in the rice industry.
2.5 Experiment Title	***:***	***Design and Development of a Two-Stage Rice Mill***
Name of Investigator (s)	:	PI: MGKB CI: MDH, BCN, SP, MMR
Objectives	:	• To design and fabricate a two-stage rice mill • To evaluate the performance of the fabricated rice mill • Compare the performance with the engelberg huller
Location (s)	:	FMPHT division and M/S Salam Engineering Works, Gopalganj Bazar, Dinajpur
Status of the Experiment	:	❖ On-going (continuous) Starting Date: 01-07-2024 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	❖ Design, fabrication, evaluation, and improvement of the two-stage rice mill will be part of the proposed program. Standard engineering procedures will be followed to design the size, type, and number of belts, sheave size, take-up allowance for the idler sheave, power transmission mechanism, and other relevant components. **Fabrication** ❖ Prototypes will be fabricated in the FMPHT divisional research workshop based on the design. **Data to be collected during laboratory and research field tests** ❖ Milling performance for different varieties under different conditions ❖ Cost analysis and pay-back period of the mill ❖ Load-bearing capacity under different feeding rates
Expected output	:	•A suitable two-stage rice mill will be available.
2.6 Experiment Title	***:***	***Design and Development of Paddy Collector***
Name of Investigator (s)	:	PI: MGKB CI: MDH, BCN, SP, HR, MMA
Objectives	:	• To design and develop a Paddy collector • To evaluate the performance of the fabricated collector • Compare the collector with the manual method • Disseminate the Paddy collector
Location (s)	:	FMPHT division
Status of the Experiment	:	❖ On-going (continuous) Starting Date: 01-07-2024 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	❖ The study will be conducted at the Farm Machinery and Post Harvest Technology (FMPHT) Division, BRRI, Gazipur. The design will be done using AutoCAD Engineering Drawing tools. ❖ The prototype will be fabricated according to the design and drawing ❖ After fabrication, the FMPHT divisional workshop will evaluate the prototype. ❖ Required data will be collected and analysed.
Expected output	:	❖ An innovative paddy collector will be introduced to the farmers. ❖ Paddy collection will be more accessible in a bag
2.7 Experiment Title (New)	***:***	***Development of a Small-Scale Boiler for Small-Scale Rice Millers***
Name of Investigator (s)	:	PI: MAH CI: BCN, SP, MAUK, MMA

Objectives	:	• Develop a cost-effective, fuel-efficient boiler suitable for small-scale rice millers. • Ensure that the boiler operates safely and efficiently while minimizing environmental impact. • Utilize locally available materials and technology to make it accessible for small millers. • Enhance the parboiling process by improving steam generation and heat transfer efficiency.
Location (s)	:	FMPHT Divisional Workshop
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2029
Plan of activities to achieve the objective (s)	:	• **Compact and Portable:** Designed for ease of transportation and installation. • **Fuel Efficiency:** Ability to operate on locally available biomass, husk, or other alternative fuels. • **Safety Features:** Equipped with pressure relief valves, temperature control systems, and efficient combustion mechanisms. • **High Thermal Efficiency:** Improved heat transfer mechanisms to optimize steam production. • **Ease of Maintenance:** Simple design for easy cleaning and maintenance by small-scale millers.
Expected output	:	• Enhanced efficiency and productivity for small-scale rice millers. • Reduction in energy costs by utilizing locally available biomass. • Improved rice quality due to better steam generation. • Increased sustainability in the rice milling sector.
2.8 Experiment Title (New)	***:***	***Design and development of a portable mini rice mill with an integrated grinder for small-scale use.***
Name of Investigator (s)	:	PI: SP CI: BCN, MDH, MGKB, MR, MMA
Objectives	:	• To develop and fabricate a cost-effective portable mini rice mill • To develop a multifunctional system with a grinding facility • To evaluate the performance of the developed mill
Location (s)	:	FMPHT Divisional Workshop
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2028
Plan of activities to achieve the objective (s)	:	**Design and Fabrication** • Design the machine using CAD/SolidWorks software to ensure optimal dimensions and integration of milling and grinding units. • Fabricate the frame and mount all components, including the milling drum, grinding plates, motor, and transmission system. **Integration of Milling and Grinding Functions** • Install a dual-purpose system, ensuring that the rice milling unit can operate independently or simultaneously with the grinding unit. • Test the compatibility of both functions to ensure smooth and efficient operation without interruptions. **Testing and Optimization** • Test the machine with varying quantities of paddy and by-products to evaluate milling efficiency, grinding performance, and power consumption. • Optimize the design by adjusting drum speed, grinding plate clearance, and motor power to achieve maximum efficiency. **Data Collection and Analysis** • Record data on milling capacity (kg/hour), grinding efficiency (fineness of output), energy consumption, and operational costs, etc. • Analyze results to compare performance against traditional methods and large-scale machines.

		Field Testing • Deploy the machine in rural settings for field testing. • Collect feedback from users to identify further improvements
Expected output	:	• A fully functional, lightweight, cost-effective, and user-friendly compact mini rice mill with integrated grinding capability will be developed for easy transportation and use in rural and remote areas. • The efficiency of rice milling will be enhanced with minimal grain breakage and a grinding unit for processing by-products.
3 Project Title	***:***	***Development of stores and storage technology***
Project Objectives	:	• To increase the shelf life of rice in the store
3.1 Experiment Title	***:***	***Effect of ageing on milling performance of premium quality rice***
Name of Investigator (s)		PI: S Islam CI: MAH, MDH, MGKB, MMR, HP
Objectives	:	• To observe the milling performance of BRRI dhan50 at different aging
Location (s)	:	• FMPHT divisional workshop
Status of the Experiment	:	❖ On-going (Modified) Starting Date: 01-07-2017 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	❖ Premium quality paddy, rice mill, balance, moisture meter, plastic drum, etc,. will be needed to conduct this program. ❖ BRRI dhan50 will be stored in the proven storage system (plastic drum). ❖ Milling quality will be assessed every two months up to two years from the time of storage.
Expected output	:	The appropriate milling age of BRRI dhan50 will be decided.
4 Project Title	***:***	***Renewable Energy Technology***
Project Objectives	:	• Development of renewable energy extraction technologies from solar, agri-residues, and waste products
4.1 Experiment Title	***:***	***Study on solar energy utilization for small agricultural machinery***
Name of Investigator (s)	:	PI : S Paul CI: MDH, MGKB, MMR, MAH, HR (WMM)
Objectives	:	• To design the mechanism of solar energy utilization • To evaluate the performance of the developed machine
Location (s)	:	FMPHT Lab and Gazipur
Status of the Experiment	:	❖ On-going (Modified) Starting Date: 01-07-2021 Expected Completion Date: 30-07-2026
Plan of activities to achieve the objective (s)	:	❖ Solar (PV) panels, Engine, three-phase motor, controller, inverter, battery, bulb, electric cable, digital multi-meter, GI pipe, GI sheet, MS sheet, MS flat bar, and MS shaft will be used for fabricating the solar system ❖ A flow chart diagram of the developed process will be done ❖ The solar energy system will be developed and tested for the operation of small agricultural machinery.
Expected output	:	• Solar-operated power machinery will be developed. • Operation costs will be reduced
4.2 Experiment Title	***:***	***Design and develop a solar-powered smart bird-repellent***
Name of Investigator (s)	:	PI: MMR CI: MMH, MHR, SP, MDH
Objectives	:	• To design an audio player using Arduino software • To identify the scary melodies for granivorous birds • To test the performance
Location (s)	:	FMPHT Lab and Gazipur
Status of the Experiment	:	❖ On-going (continuous)

		Starting Date: 01-07-2023 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	❖ The research will be conducted at the Farm Machinery and Postharvest (FMPHT) Division in BRRI, Gazipur. The framework of the bird repellent will be designed using SolidWorks 2013. The physical structure will be constructed using GI pipes, GI sheets, MS sheets, MS flat bars, angle bars, and plain sheets. The power requirements of the entire system will be considered to determine the appropriate size of the solar panel and battery. A custom audio sound system will be devised to discourage birds from entering the crop area. The sound system will incorporate features to produce 20 unsettling melodies to deter birds. These melodies will play for 15 seconds each, effectively notifying the birds of potential danger within the vicinity. These auditory stimuli will be created using Arduino software. The process of developing the audio player will encompass the following steps: ❖ Hardware & software ❖ Design a circuit ❖ Program development ❖ Create an audio file format ❖ Build an external audio amplifier ❖ Testing
Expected output	:	Develop a user-friendly, smart bird repellent that will enhance food security.
4.3 Experiment	***:***	***Design and development of solar power-operated sprayer***
Name of Investigator (s)	:	PI: MMA CI: GKB, HR, SP, MMR, MMS
Objectives	:	❖ To design and fabricate a solar-power-operated sprayer ❖ To evaluate the performance of the sprayer
Location (s)	:	BRRI, Gazipur, and Fermers' field
Status of the Experiment	:	❖ On-going (continuous) Starting Date: 01-07-2023 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	The study will be conducted at the Farm Machinery and Postharvest (FMPHT) Division, BRRI, Gazipur. The solar sprayers will be designed using AutoCAD engineering drawings. After developing this system, it could be automated using a microcontroller that the solar panel rotates according to sunlight. The following materials will be used to fabricate the physical shape of the sprayers: ❖ Solar panel (20W) ❖ Motor (12V) ❖ Battery D.C (12V, 8A) ❖ Charge controller (12 V) ❖ Tank (16 L) ❖ Nozzle (.75 mm) ❖ Connecting wire (4 mm)
Expected output	:	An effective and eco-friendly sprayer will be developed.
4.4 Experiment	***:***	***Design and Development of Automated Rodent Trap for Reducing Post-Harvest Losses of Rice***
Name of Investigator (s)	:	PI: MMA CI: GKB, HR, SP, MMR, MMS
Objectives	:	• Design and development of an automated rodent trap • Performance evaluation of the fabricated trap
Location (s)	:	BRRI, Gazipur, and Fermers' field
Status of the Experiment	:	❖ On-going (continuous)

		Starting Date: 01-07-2023 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	The study will be conducted at the Farm Machinery and Post Harvest Technology (FMPHT) Division, BRRI, Gazipur. The layout of the automated mouse trap will be designed in Auto CAD Engineering Drawing tools. The following materials will be used to provide the physical shape of the automated mouse trap: • Motor (6 V DC) • PIR Sensor • Circuit • LED light • Lithium battery (3.7V, 1000mAh) etc.
Expected output	:	• Eco-friendly mouse trap will be developed • Post-harvest loss will be reduced
4.5 Experiment	***:***	***Production of pellets from rice byproducts***
Name of Investigator (s)	:	PI: BCN CI: SP, MMA, MDH
Objectives	:	• To make pellets from rice straw biomass • To assess the physicochemical properties of the developed pellet
Location (s)	:	FMPHT Lab and Gazipur
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2028
Plan of activities to achieve the objective (s)	:	The study will be conducted at the Farm Machinery and Postharvest Technology (FMPHT) Division, BRRI, Gazipur. The pelleting machine will be purchased from the market. The following materials will be used to manufacture the pellet: Maize starch (Binding material), Crude grease/ used oil (Oily material), and rice straw. **Machinery** The pellet machine, grinding machine, etc. **Data will be collected:** • Moisture content of feed and pellets (%); • Size of feed (mm); • Feed rate (kg/h); • Rotation speed of machine (rpm); • Capacity of machine (kg/h); • Dimensions of pellets (mm); • Bulk density of feed and pellets (kg/m3); • Pellet density (kg/m3); • Calorific value of pellets (kJ/kg).
Expected output	:	A cost-effective mechanical grain collector will be developed
4.6 Experiment	***:***	***Design and development of a pyrolysis oven/kiln for biochar production***
Name of Investigator (s)	:	PI: MMA CI: MAH, BCN, SP, MAfH, JN, MSK
Objectives	:	• To design and fabricate a pyrolysis oven/kiln • To assess the performance of the developed machine
Location (s)	:	FMPHT workshop, BRRI farm, Gazipur, and other locations
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2028
Plan of activities to achieve the	:	The study will be conducted at the Farm Machinery and Postharvest

objective (s)		Technology (FMPHT) Division, BRRI, Gazipur. The layout of the pyrolysis kiln will be designed using an AutoCAD Engineering Drawing. The following materials will be used to provide the physical shape of the pelleting machine: • Temperature controller • Electric motor (3 Phase) • Sensor • MS Sheet • MS Bar **Data will be collected:** • Moisture content of biochar (%); • Size of feed (mm); • Feed rate (kg/h); • Rotation speed of machine (rpm); • Capacity of machine (kg/h); • Dimensions of biochar (mm); • Bulk density of biochar (kg/m3); • Biochar density (kg/m3); • Calorific value of biochar (kJ/kg).
Expected output	:	• A cost-effective pyrolysis oven will be developed • A good quality biochar will be developed
5 Project Title	***:***	***The popularization of BRRI-developed farm machinery and Postharvest technology***
Project objective(s)	:	• Awareness builds up about the benefits of using BRRI machines among the farmers • The motivation of the local manufacturer to manufacture the BRRI agricultural machinery
5.1 Experiment Title	***:***	***Industrial and farm-level extension of BRRI machinery and Postharvest technology***
Name of Investigator (s)	:	PI : AKMSI CI: All division scientists
Objectives	:	• To create awareness and demonstrate the benefit of using BRRI machines among farmers • To motivate the local entrepreneurs to manufacture BRRI-developed machinery
Location (s)	:	All over the country
Status of the Experiment	:	❖ On-going (continuous) Starting Date: 01-07-1998 Expected Completion Date: Continued
Plan of activities to achieve the objective (s)	:	❖ BRRI-developed agricultural machines will be demonstrated at selected sites in the presence of farmers Agril. officers/NGO personnel/manufacturers/Bankers ❖ Display of BRRI machines at the exhibition, the agricultural fair will be arranged ❖ Participant's opinions will be recorded after the demonstration ❖ RRA will be conducted before the demonstration
Expected output	:	The entrepreneur will be trained to use the machine in the rental system.
5.2 Experiment Title	***:***	***Training on the operation, repair, and maintenance of farm machinery***
Name of Investigator (s)	:	PI: MGKB CI: All divisional scientists
Objectives	:	• To impart knowledge to the farmers/operators/mechanics/extension workers/entrepreneurs about the effective use of farm machinery

		• To develop skilled operators and mechanics
Location (s)	:	BRRI HQ and RS
Status of the Experiment	:	❖ On-going (continuous) Starting Date: 01-07-2020 Expected Completion Date: Continued
Plan of activities to achieve the objective (s)	:	❖ Training in the operation, repair, and maintenance of farm machinery will be organized in different locations in the country
Expected output	:	Skilled machine operators can be found in various locations throughout the country.
6 Project Title	:	**Smart Agricultural Technology**
Project objective(s)	:	To apply ICT in Agriculture
6.1 Experiment Title	:	***Detection of Pests Affected Areas in Rice Farming Using Remote Sensing and Machine Learning Techniques***
Name of Investigator (s)	:	PI: MMR CI: MMH, MKM, AUK, HR, MSH
Objectives	:	• To enhance natural pest control measures for precision rice farming • To limit the environmental hazards • To validate the results with ground truth data
Location (s)	:	All over the country
Status of the Experiment	:	❖ On-going (continuous) Starting Date: 01-07-2023 Expected Completion Date: 30-06-2026
Plan of activities to achieve the objective (s)	:	❖ This study will be completed using two phases. A time series classification based on SAR imagery is implemented to identify cultivated paddy fields in the first phase. Ratio vegetation index (RVI) and standard difference indices (SDI) will be derived from optical satellite images and used in the second phase to identify regions affected by BPH attacks in paddy fields (Lakmal et al., 2019). A Support Vector Machine is used to detect areas damaged by BPH attacks in the second phase. The Combine approach of the first and the second phases will be applied to detecting Brown Planthopper attacks. The outputs will be validated with the field survey data.
Expected output	:	The rice pests that affect damaged areas will be detected before creating a hazardous situation in rice farming.
6.2 Experiment Title	:	***Assessing the future rainfall and temperature extremes from CMIP6 GCMs and their potential risk to rice cultivation in Bangladesh***
Name of Investigator (s)	:	PI: MKM CI: MSR, MMR
Objectives	:	• Assessing future changes in rainfall and temperature extremes based on data from the CMIP6 global climate models (GCMs). • Evaluating the potential risks associated with these changes to rice cultivation in Bangladesh.
Location (s)	:	All over the country
Status of the Experiment	:	❖ On-going (continuous) Starting Date: 01-07-2020 Expected Completion Date: 30-06-2026
Plan of activities to achieve the objective (s)	:	❖ Obtain relevant climate data from the CMIP6 GCMs for the region of Bangladesh. This data should include projections of future changes in temperature and precipitation extremes. ❖ Analyze the data to identify trends and patterns in the projected changes. This could involve using statistical methods to quantify the magnitude and frequency of extreme events, such as heat waves, droughts, and heavy rainfall.

		❖ Assess the potential impacts of these changes on rice cultivation in Bangladesh. This could involve examining the sensitivity of rice yields to changes in temperature and precipitation and considering other factors, such as soil quality and irrigation availability. ❖ Use this information to develop strategies for adapting to the potential risks identified. This could involve crop diversification, irrigation improvements, and the development of heat- and drought-resistant crop varieties. ❖ Overall, this assessment aims to provide policymakers and stakeholders in Bangladesh with information that can help them prepare for and mitigate the potential impacts of climate change on rice cultivation and food security in the region.
Expected output	:	• Future changes in rainfall and temperature extremes will be known
6.3 Experiment Title	:	***Developing a high-resolution daily gridded precipitation and temperature data set for Bangladesh during 1961–2020***
Name of Investigator (s)	:	PI: MKM CI: MMR, MS
Objectives	:	• Compile high-quality historical rainfall and temperature data. • Preprocess and clean data. • Assess covariates' influence on rainfall patterns. • Develop models using cross-validation. • Homogenize data series. • Interpolate gridded daily data. • Validate and evaluate dataset accuracy. • Adjust the dataset for reliability.
Location (s)	:	All over the country
Status of the Experiment	:	❖ On-going (continuous) Starting Date: 01-07-2024 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	❖ Data Collection and Preprocessing ❖ Covariate Assessment ❖ Model Development and Cross-Validation ❖ Data Homogenization ❖ Thin-Plate Spline Interpolation ❖ Data Validation ❖ Evaluation and Adjustment of Spatial Variability
Expected output	:	• High-resolution daily gridded precipitation and temperature dataset for Bangladesh (1-kilometer grid). • Daily data coverage from 1901 to 2020. • Rigorous data quality control and validation processes. • Accessibility to the scientific community, policymakers, and the public. • Detailed documentation on data sources, methodologies, and limitations. • User-friendly data exploration and visualization tools.
6.4 Experiment Title	:	***Assessing Potential Rice Exposure to Heat Stress in Bangladesh under Different SSPs***
Name of Investigator (s)	:	PI: MKM CI: MMR, MS
Objectives	:	• Assess the potential exposure of rice to heat stress in Bangladesh under various Shared Socioeconomic Pathways (SSPs). • Provide valuable insights into agricultural and climate adaptation policies.
Location (s)	:	All over the country

Status of the Experiment	:	❖ On-going (continuous) Starting Date: 01-07-2024 Expected Completion Date: 30-06-2027
Plan of activities to achieve the objective (s)	:	❖ Data collection of rice phenology records in Bangladesh. ❖ Data collection of daily temperature projections under different SSPs. ❖ Development of a regional heat stress index. ❖ Simulation of rice phenology processes. ❖ Assessment of historical data. ❖ Projection of future rice phenology under different SSPs. ❖ Analysis of potential trends in heat stress exposure. ❖ Comparative analysis with Chinese study results. ❖ Policy and adaptation strategy development. ❖ Final report preparation.
Expected output	:	➢ Assessment of spatiotemporal changes in rice phenology. ➢ Identification of hot spots in Bangladesh prone to heat stress. ➢ Development of a heat stress exposure index ➢ Projection of potential trends in rice exposure to heat stress under different SSPs. ➢ Recommendations for mitigation and adaptation strategies to ensure rice production security.
6.5 Experiment Title	:	***Development and Utilization of a Drone in Agriculture***
Name of Investigator (s)	:	PI: SP CI: BCN, MDH, MGKB, MMR
Objectives	:	• To develop and assemble a drone for Agriculture • To evaluate the performance of the developed drone • To deploy the drone in Agriculture
Location (s)	:	FMPHT workshop and Fulbari, Dinajpur and other places
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2030
Plan of activities to achieve the objective (s)	:	The study will be conducted at the Farm Machinery and Postharvest Technology (FMPHT) Division, BRRI, Gazipur and Fulbari, Dinajpur district. The design, development, and assembly process will be done in the BRRI research workshop/ Drone RC BD, Fulbari, Dinajpur, under a public-private partnership (PPP) to develop a drone. AutoCAD/SolidWorks engineering tools will be used for design and drawing. **a. Design Phase:** • A needs assessment will be conducted. • Will collaborate with drone experts to design a prototype sprayer system. • Factors such as payload capacity, spraying mechanism, flight stability, and power source will be considered. **b. Development Phase:** • Procure necessary components and materials for developing the prototype. • Assemble the sprayer system according to the finalized design. • Integrate sensors and control mechanisms for precise spraying and navigation. • Conduct rigorous testing in controlled environments to validate performance and identify potential issues. **c. Evaluation Phase:** • Field trials will be conducted in various agricultural settings to assess

		the effectiveness. • The drone's performance will be compared with that of traditional spraying methods. • Data on coverage, application rate, crop damage, and operational efficiency will be collected. • Feedback will be gathered from farmers and stakeholders to inform them about further improvements.
Expected output	:	• An agricultural drone will be available
6.6 Experiment Title	:	***Assessing Land Suitability for Combine Harvester and Rice Transplanter in Bangladesh Using Remote Sensing and Machine Learning in Google Earth Engine***
Name of Investigator (s)	:	PI: MMR CI: MDH, GKB, MKM, BCN, SP and MSK
Objectives	:	• To generate detailed suitability maps for Combine Harvester and Rice Transplanter in Bangladesh. • To assess the accuracy of these models, and • To estimate for Combine Harvester and Rice Transplanter in Bangladesh
Location (s)	:	All over the country
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2030
Plan of activities to achieve the objective (s)	:	**Study Area** The study will be conducted in Bangladesh based on the target rice cultivation zone. The study area will be defined using administrative boundaries or specific geographical coordinates within the Google Earth Engine platform. **Data Collection & Processing** • Sentinel-2: NDVI (Crop Health) & NDWI (Soil Moisture). • SRTM DEM: Slope (for terrain suitability). • Road Proximity: Accessibility for machinery. • Soil Data: Bulk Density (Soil Compactness). • Sentinel-1 SAR: Flood History. • CHIRPS Rainfall: Precipitation data. **Stack Features for Clustering:** All the derived features NDVI, NDWI, slope, road proximity, soil compactness, and flood history will be combined into a feature stack. This comprehensive feature set will be used for clustering farmland into different suitability categories for machinery deployment. **Modeling Process** • K-Means Clustering: Group areas into suitability categories. • Sample Training Data from Clusters: Create a labeled dataset for model training based on cluster categories. • Load Manually Refined Training Data: Integrate manually adjusted data to improve accuracy and refine model classification. • Machine Learning (Random Forest & XGBoost): Classify land suitability for combine harvesters and rice transplanters. **Evaluation:** Accuracy metrics.
Expected output	:	The expected outcomes of this study include detailed suitability maps for mechanized rice harvesting and transplanting, which will help optimize agricultural machinery deployment in the study area. The methodology developed can be scaled to other regions with similar agricultural conditions, contributing to more efficient and sustainable agricultural practices.
6.7 Experiment Title	:	***Application of a drone for the identification of pest-infected rice***

		fields
Name of Investigator (s)	:	PI: MAfH CI: MMA, MGKB
Objectives	:	• To identify the disease-infected rice field and apply pesticides as per requirement
Location (s)	:	FMPHT division
Status of the Experiment	:	❖ New Starting Date: 01-07-2025 Expected Completion Date: 30-06-2030
Plan of activities to achieve the objective (s)	:	
Expected output	:	

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