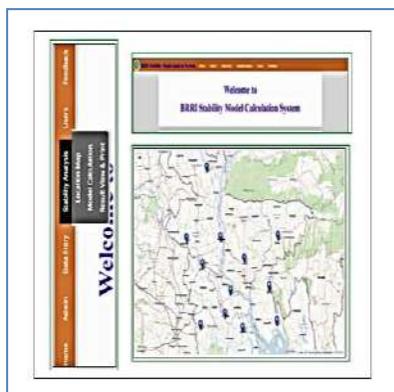
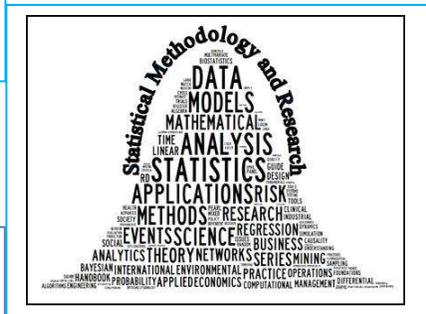
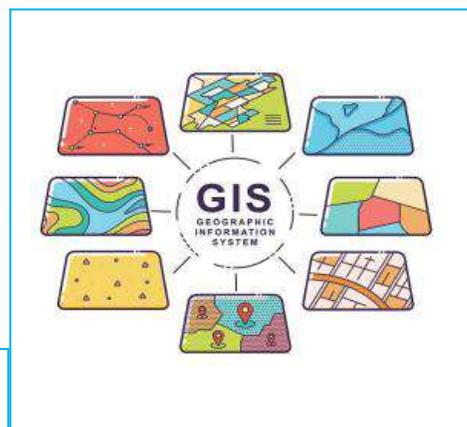
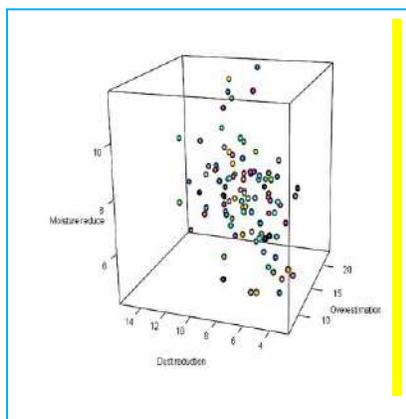


ANNUAL RESEARCH REVIEW WORKSHOP

2024-25



XIV

AGRICULTURAL STATISTICS DIVISION



BANGLADESH RICE RESEARCH INSTITUTE

GAZIPUR 1701

CONTENTS

| | |
|-----------------|--|
| Page No. | |
| ii | Personnel |
| iii | Summary |
| 1 | Statistical methodology in Rice Research |
| 1 | Stability Analysis of BRRI Varieties |
| 6 | Multivariate analysis of BRRI varieties |
| 6 | Genotype × Environment Interaction of BRRI Varieties |
| 9 | Rice and Rice Related Database |
| 9 | Rice database and analysis system (RDAS) |
| 10 | Maintenance of Rice and related Database |
| 13 | Utilization of geographical information system (GIS) in rice research |
| 13 | Suitability (Edaphic) Mapping of BRRI released varieties (BRRI dhan103 to BRRI dhan106) |
| 14 | Climate Mapping of Temperature and Rainfall of Bangladesh |
| 14 | Season Wise Rice Area Mapping of Bangladesh |
| 16 | Projected Climatic Factors (2050) Maps of Bangladesh |
| 17 | Suitability Mapping of Various Cropping Pattern |
| 18 | Rice yield forecasting using satellite image and machine learning in Habiganj district |
| 19 | Delineation of Rice Area changes in Costal Area of Bangladesh Using Remote Sensing Data and Machine Learning Approach |
| 20 | Capacity building through training |
| 20 | Training Program on Experimental Data Analysis |
| 20 | Training Program on Multivariate Data Analysis |
| 21 | Computer programming, Software Development and Digitization |
| 21 | Develop an online integrated platform for collecting rice mapping data |
| 22 | Digitalized Tour Bill Management System for BRRI HQ |
| 23 | Digitalized Labour Management System of BRRI |
| 24 | Information and communication technology (ICT) |
| 24 | Develop real time dashboard-based monitoring system for location-specific insect and disease using artificial intelligence (AI) and Machine Learning Method (MLM). |
| 25 | Develop an artificial intelligence (AI) based interactive e-Agriculture software & databank for research data. |
| 25 | Smart Profiling of Rice Varieties in Bangladesh |
| 26 | Sensor-based Rice pest management through Artificial Intelligence (AI) Technology of BRRI |
| 27 | New version of rice knowledge bank (RKB) mobile Apps |
| 28 | Develop a New Website for BRRI |
| 29 | Vehicle Requisition Management System of BRRI |
| 30 | Training on Innovation, Service Process Simplification (SPS) and e-Nothi Management for Enhancing Capacity of BRRI Employee |
| 30 | BRKB Website Management of BRRI |
| 31 | BRRI Web Portal Management |
| 32 | Support Services and ICT related fair |

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Summary

T. Aman varieties, BRRI dhan49, BRRI dhan87, BRRI dhan103 and BRRI hybrid dhan6 were found stable. The variety BRRI dhan91 were found to be unstable during T. Aman season. Among the aromatic rice BRRI dhan5, BRRI dhan34, BRRI dhan37 and BRRI dhan38 were found as below average stable in T. Aman season. Boro varieties, BRRI dhan89, BRRI dhan92 and BRRI hybrid dhan8 were found stable. The variety BR17 were found to be unstable during Boro season. On the other hand, only aromatic rice varieties BRRI dhan50 appeared to below average stable.

In the Aman season, BR11 and BRRI dhan44 recorded the highest average grain yielder and ideal genotypes among long-duration varieties. BRRI dhan103, BRRI dhan94, and BRRI dhan93 were the most stable genotypes with above-average yield in medium duration, where BRRI dhan87, BRRI dhan72, and BRRI Hybrid dhan6 were the most stable genotypes and above average yielder for short duration.

The web-based application successfully integrates multiple datasets and graphical interface. Primary data were inserted in different categories including rice and weather patterns data.

Rice area increased about more than one folds but the production increased about four folds during 1971-72 to 2023-24. Although the growth rate of rice area was 3.96 in year 1972-73 but in 2023-24 is 0.23. Similarly, growth rate of rice production was 1.30 in year 1972-73 but in 2023-24 is 4.10.

BRRI dhan103 is appropriate for north-west and some part of central southern area. But BRRI dhan104 is suitable in all over of the country, in addition BRRI dhan105 is suitable in north-east part. On the other hand, BRRI dhan106 is appropriate for north-east part of Bangladesh.

More or less throughout the year eastern side of Bangladesh is high rainfall and low temperature area and western side is low rainfall and high temperature area. Spatial distribution of minimum temperature and total rainfall are more or less same.

About 5.63 Mha of rice were farmed overall in 2024 during Aman season and highest Aman production district was Naogaon. In 2023 total Aman area was 5.91 Mha. Thus, total Aman area has been decreased a little bit in the year 2024 because of sudden flood in cumilla region. In 2024-25 total Boro area was about 4.93 Mha in Bangladesh. Naogaon district produced the highest Boro production in 2024-25.

Average total precipitation (average by RCP 2.6, 4.5, 6.0, and 8.5 models) of Bangladesh of August month in 2050 will be decreased in comparison to average total precipitation of 2010-2018 period, only exceptions are Khulna, Rajshahi, Mymensingh divisions.

Boro-Fallow-Fallow cropping pattern is suitable in north-east part and total suitable area is 3.01 Mha. Mustard-Boro-Fallow cropping pattern covers an area of 1.96 Mha and is suitable in north-east side. Onion-Jute-T.Aman is suitable in north-west side of Bangladesh and total suitable area is 1.60 Mha

Among the random-forest, support Vector, linear-regression and ensemble model, found that the linear regression model is the best fitted model for yield prediction.

The Rice area has increased sufficiently in 2024 as compare to 2018 in Maksudpur upazila. The notable change was in the area of rice, which increased by 37.17 percent.

In the reporting year, two types of training were conducted under “Capacity Building through Training” programme. A total of 80 participants were trained through the training programmes. The participants of these training were scientists and SA, FM and AFM of BRRI.

Developed a database and web application System using XAMPP, HTML, PHP and JavaScript but not hosted yet.

For digitalized labour management system of BRRI Web Application software already been developed and hosted in a server (BRRI LAN). A total of 160 users were used 15857 times of the software and 333469 attendances were entries about 491 labours.

Developed Sensor-based rice pest management through Artificial Intelligence (AI) technology named “ধান সুরক্ষা (Rice Solution)” mobile App and also developed a real time dashboard management system as an automated decision support tool which is useful to all stakeholder i.e. policy maker, researcher, extension personnel and farmer. Also, developed Rice profiling App of the rice varieties for a specific environment and quickly picking up the preferred one(s). Developed new website named Glory and success of 50 years (<https://gsfy.brri.gov.bd>) for national and international seminars and symposiums of BRRI. Developed dynamic view connectivity, Bangla search and inner banner system for BRKB web apps. Besides, modified the RKB mobile apps and disseminate of modern rice technology and its management information at the farmer door step through RKB Mobile Apps. Besides, developed Vehicle Requisition Management System (VRMS) of BRRI. So that, the requester informed through SMS on basis of demanding vehicle for official or personal purpose as well as driver get confirmation SMS for their upcoming duty. Also, manage and maintain BRRI Web Portal through regular updating of the information and documents. We organized five day-long, two day-long, day-long ‘Public Service Innovation’ training workshops in the reporting year.

Project 1: Statistical methodology in Rice Research

Experiment 1.1: Stability Analysis of BRRI varieties

(In collaboration with Plant Breeding Div., Plant Physiology Div., Agronomy Div., ARD and BRRI R/S's)

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Introduction

Stability models developed by Comstock and Robinson (1952), do not consider the response of environment on genotypic variation in identification of stability of the genotypes and thus, there is no information on how the genotypes will behave under rich, average or poor environment. On the other hand, Finlay and Wilkinson's (1963), also Eberhart and Russell (1966) used the concept of regression analysis in their stability models. The most serious and logical objection to the regression technique for stability analysis is that the site means or the environmental indices, which are employed as independent variables, are essentially not independent of the dependent variables, i.e., genotype means. Another serious limitation of the stability models those use regression technique is for the regression coefficients, use for measuring the stability of varieties which are unreliable due to poor to very poor fit of the regression model to the observed data in most of the cases. Thus, the models that use the regression technique to determine the varietal stability is not out of criticism. So, a new model was developed for stability analysis of genotypes in the year 2004-05 that avoids the jargons of regression analysis and uses a single index to identify the stability of a genotype across different environments and calibration and fine-tuning work on the model is doing since last year.

Objectives

1. To determine the stability index of BRRI released varieties
2. To maintain season, year and location-wise database on BRRI varieties.
3. To determine the interaction of BRRI varieties (genotypes) across all the environment

Materials and Method

Experiments are being conducted in T. Aman season and Boro with BRRI released rice varieties since 2001-2025 at Gazipur and different regional stations. The collaborative regional stations in the T. Aman season are Rajshahi, Rangpur, Cumilla, Sonagazi, Barishal, Satkhira and Kushtia and in the Boro season Rajshahi, Rangpur, Cumilla, Habiganj, Barishal, Bhanga, Satkhira, Sonagazi and Kushtia. The numbers of varieties are 48 and 54 in T. Aman and Boro season respectively. The design was RCB with three replications and the effective plot size (harvest area) was 3.0-x-3.2 m² leaving the two-border row from each side. Recommended crop management practices were followed. Stability analysis of the experimental data was performed by using a newly developed model. The model deals with the performance of the genotypes across the geographical locations differing in land, soil and other biotic and abiotic factors over the years characterizing fluctuation of weather variable, floods, drought etc. Stability analyses of the experimental data were performed following the newly BRRI developed model, which is described below:

The stability model

The newly developed stability model takes into account the performance of the genotypes across the geographical locations differing in land, soil and other biotic and abiotic factors over the years characterizing fluctuation of weather variable, floods, drought, etc.

In the new model, the stability of a genotype is determined by three parameters. These are:

(1) Measure of yield fluctuation of ith variety, $s_i = \frac{\sum_{j=1}^s S_{ij}}{s}$

S_{ij} is the coefficient of variation (CV) of the yield index of ith variety in jth location and is computed as,

$S_{ij} = \frac{V_{ij}}{\bar{z}_i} \times 100$, where $V_{ij} = \sqrt{\frac{\sum_{k=1}^t (z_{ijk} - \bar{z}_{ij})^2}{t}}$ = yield index of ith variety in jth location,

and, $\bar{z}_{ij} = \frac{\sum_{k=1}^t z_{ijk}}{t}$

where, $z_{ijk} = \frac{\bar{y}_{ijk}}{\bar{y}_{jk}}$ = Yield index of ith variety in jth location and kth year with respect to average yield of all varieties in jth location and kth year

$$\bar{y}_{ijk} = \frac{\sum y_{ijkl}}{r} = \text{Average yield of } i^{\text{th}} \text{ variety in } j^{\text{th}} \text{ location and}$$

$$k^{\text{th}} \text{ year } \bar{y}_{jk} = \frac{\sum \bar{y}_{ijk}}{v} = \text{Average yield of all varieties in } j^{\text{th}} \text{ location and } k^{\text{th}} \text{ year}$$

$$y_{ijkl} = i^{\text{th}} \text{ variety yield of } l^{\text{th}} \text{ replication in } j^{\text{th}} \text{ location and } k^{\text{th}} \text{ year.}$$

v = no. of variety, s = no. of location, t = no. of years and r = no. of replication.

$$(2) \text{ Measure of performance of } i^{\text{th}} \text{ variety, } D_i = \frac{\sum_{j=1}^s d_{ij}}{s}$$

$$(3) \text{ Measure of superiority of } i^{\text{th}} \text{ variety in } j^{\text{th}} \text{ location, } d_{ij} = \frac{(\bar{z}_{ij} - \bar{z}_j)}{\bar{z}_j} \times 100; \text{ where, } \bar{z}_j = \frac{\sum_{i=1}^v \sum_{k=1}^t z_{ijk}}{tv}.$$

A variety for which S_i is the minimum, $d_{ij} \geq 0$ for all j and D_i is a positive maximum, is defined as the most stable variety among the alternatives: stable across the locations and over the years.

In other words, a variety to be stable

- Should have minimum variability than other varieties
- Should yield consistently higher than other varieties across the locations and
- Should have higher yield than other varieties over locations and years

Combining the three quantities S_i , D_i and d_{ij} , the stability index of i^{th} genotype is defined as:

$$G_i = (F_i^I + P_i^I + S_i^I)$$

$$\text{where, } F_i^I = \text{Fluctuation index of } i^{\text{th}} \text{ variety} = \frac{\text{Min}(S_i)}{S_i}, i = 1, 2, 3, \dots, v$$

$$P_i^I = \text{Performance index of } i^{\text{th}} \text{ variety} = \frac{D_i}{\text{Max}(D_i)}, i = 1, 2, 3, \dots, v$$

$$S_i^I = \text{Superiority index of } i^{\text{th}} \text{ variety} = \frac{P_i}{t \times s}, i = 1, 2, 3, \dots, v$$

$$P_i = \text{No of times the } i^{\text{th}} \text{ variety exceeded } \bar{z}_{ij} \text{ in all locations and year.}$$

The value of G_i ranges from -1 to $+3$ i.e., $-1 \leq G_i \leq 3$. The higher the value of G_i more is the stability of the genotype across the environments. Stability of a variety is characterized as follows:

| Value of G_i | Nature of stability |
|------------------|----------------------|
| ≤ 0 | Unstable |
| $0 < G_i \leq 1$ | Below average stable |
| $1 < G_i \leq 2$ | Average stable |
| $2 < G_i \leq 3$ | Stable |

Results and Discussion

Among the non-aromatic T. Aman rice varieties, BRRi dhan49, BRRi dhan87, BRRi dhan103 and BRRi hybrid dhan6 were found stable with stability index 2.00, 2.05, 2.27 and 2.03 respectively. while BR3, BR23, BR25, BRRi dhan33, BRRi dhan39, BRRi dhan41, BRRi dhan46, BRRi dhan56, BRRi dhan57, BRRi dhan62, BRRi dhan70, BRRi dhan75, BRRi dhan76, BRRi dhan77 and BRRi dhan90 appeared to be below average stable. Whereas, BR4, BR10, BR11, BR22, BRRi dhan30, BRRi dhan31, BRRi dhan32, BRRi dhan40, BRRi dhan44, BRRi dhan49, BRRi dhan51, BRRi dhan52, BRRi dhan53, BRRi dhan54, BRRi dhan66, BRRi dhan71, BRRi dhan72, BRRi dhan73, BRRi dhan78, BRRi dhan79, BRRi dhan80, BRRi dhan93, BRRi dhan94, BRRi dhan95 and BRRi hybrid dhan4 were found having average stability among T. Aman varieties. But, BRRi dhan91 was found to be unstable during the T. Aman season. Among the aromatic rice BRRi dhan5, BRRi dhan34, BRRi dhan37 and BRRi dhan38 were found as below average stable in T. Aman season (Table 1).

Among Boro varieties, BRRi dhan89, BRRi dhan92 and BRRi hybrid dhan8 were found as stable with stability index 2.02, 2.01 and 2.06 respectively. Whereas, BR14, BR15, BR16, BRRi dhan28, BRRi dhan29, BRRi dhan47, BRRi dhan58, BRRi dhan99, BRRi dhan100, BRRi dhan101, BRRi dhan104, BRRi dhan105, BRRi dhan108, BRRi hybrid dhan2, BRRi hybrid dhan3 and BRRi hybrid dhan5 varieties were found as average stable and rest of the 33 varieties appeared to be below average stable among the non-aromatic rice. On the other hand, only aromatic rice BRRi dhan50 were found as below average stable in Boro season. But, BR17 was found to be unstable during the Boro season (Table 2).

From the yield data 2001-2024 of BRRRI varieties the average maximum yield was observed 6.67 t/ha in T. Aman varieties and average minimum yield was observed 1.39 t/ha. From the yield data 2001-02 to 2024-25 the average maximum yield was observed 8.96 t/ha in Boro varieties and average minimum yield was observed 2.91 t/ha (Table 3). The yield differences due to lodging, lack of management, disease and insect infestation, bird and rat damage etc.

Table 1. Stability parameters of grain yield for T. Aman.

| Variety | Stability parameter | | | Stability index | Stability rank | Nature of stability |
|--------------------|---------------------|----------------|----------------|-----------------|----------------|---------------------|
| | 2001-2024 | | | | | |
| | S _i | D _i | P _i | G _i | R _i | |
| Non-aromatic rice | | | | | | |
| BR 3 | 17.89 | -9.92 | 104 | 0.63 | 39 | BAS |
| BR 4 | 13.26 | 0.09 | 93 | 1.03 | 28 | AS |
| BR 10 | 13.99 | 7.46 | 84 | 1.18 | 17 | AS |
| BR 11 | 13.93 | 7.93 | 98 | 1.27 | 12 | AS |
| BR 22 | 13.95 | 5.20 | 99 | 1.19 | 15 | AS |
| BR 23 | 16.44 | -0.06 | 96 | 0.93 | 32 | BAS |
| BR 25 | 16.08 | -2.09 | 94 | 0.88 | 33 | BAS |
| BRRRI dhan30 | 12.93 | 6.11 | 97 | 1.25 | 13 | AS |
| BRRRI dhan31 | 13.82 | 2.12 | 98 | 1.08 | 24 | AS |
| BRRRI dhan32 | 16.31 | 5.61 | 107 | 1.18 | 18 | AS |
| BRRRI dhan33 | 20.75 | -11.43 | 91 | 0.47 | 41 | BAS |
| BRRRI dhan39 | 17.08 | -2.06 | 88 | 0.82 | 35 | BAS |
| BRRRI dhan40 | 14.12 | 5.28 | 99 | 1.19 | 16 | AS |
| BRRRI dhan41 | 16.82 | 2.03 | 98 | 1.00 | 29 | BAS |
| BRRRI dhan44 | 14.07 | 7.03 | 69 | 1.18 | 19 | AS |
| BRRRI dhan46 | 15.57 | -0.25 | 71 | 0.94 | 31 | BAS |
| BRRRI dhan49 | 10.90 | 12.28 | 65 | 2.00 | 4 | S |
| BRRRI dhan51 | 16.12 | 5.88 | 55 | 1.10 | 23 | AS |
| BRRRI dhan52 | 11.65 | 9.37 | 59 | 1.42 | 9 | AS |
| BRRRI dhan53 | 13.73 | 1.91 | 52 | 1.07 | 25 | AS |
| BRRRI dhan54 | 17.73 | 5.36 | 51 | 1.05 | 27 | AS |
| BRRRI dhan56 | 16.57 | -6.75 | 58 | 0.76 | 36 | BAS |
| BRRRI dhan57 | 19.90 | -19.12 | 55 | 0.27 | 43 | BAS |
| BRRRI dhan62 | 25.90 | -20.71 | 50 | 0.17 | 44 | BAS |
| BRRRI dhan66 | 13.22 | 3.50 | 46 | 1.19 | 14 | AS |
| BRRRI dhan70 | 17.18 | -9.33 | 34 | 0.56 | 40 | BAS |
| BRRRI dhan71 | 12.52 | 8.48 | 38 | 1.32 | 10 | AS |
| BRRRI dhan72 | 11.56 | 14.08 | 34 | 1.49 | 6 | AS |
| BRRRI dhan73 | 15.13 | 3.95 | 44 | 1.16 | 21 | AS |
| BRRRI dhan75 | 15.79 | 1.96 | 37 | 0.98 | 30 | BAS |
| BRRRI dhan76 | 17.83 | -7.91 | 38 | 0.64 | 38 | BAS |
| BRRRI dhan77 | 14.07 | -5.95 | 41 | 0.84 | 34 | BAS |
| BRRRI dhan78 | 14.08 | 4.98 | 31 | 1.18 | 20 | AS |
| BRRRI dhan79 | 10.01 | 9.91 | 32 | 1.56 | 5 | AS |
| BRRRI dhan80 | 12.48 | 6.23 | 32 | 1.30 | 11 | AS |
| BRRRI dhan87 | 12.07 | 20.29 | 31 | 2.05 | 2 | S |
| BRRRI dhan90 | 14.11 | -9.02 | 20 | 0.70 | 37 | BAS |
| BRRRI dhan91 | 18.21 | -31.81 | 21 | -0.12 | 48 | US |
| BRRRI dhan93 | 10.60 | 12.81 | 23 | 1.61 | 7 | AS |
| BRRRI dhan94 | 13.25 | 12.52 | 22 | 1.45 | 8 | AS |
| BRRRI dhan95 | 16.45 | 8.27 | 19 | 1.15 | 22 | AS |
| BRRRI dhan103 | 7.19 | 21.01 | 9 | 2.27 | 1 | S |
| BRRRI Hybrid dhan4 | 17.36 | 4.95 | 36 | 1.21 | 26 | AS |
| BRRRI Hybrid dhan6 | 15.27 | 16.19 | 28 | 2.03 | 3 | S |
| Aromatic rice | | | | | | |
| BR 5 | 19.62 | -23.56 | 95 | 0.13 | 45 | BAS |
| BRRRI dhan34 | 20.33 | -26.18 | 101 | 0.06 | 47 | BAS |
| BRRRI dhan37 | 18.69 | -24.50 | 99 | 0.12 | 46 | BAS |
| BRRRI dhan38 | 16.90 | -21.05 | 100 | 0.28 | 42 | BAS |

Note: AS=Average stable, BAS=Below average stable, Stable=S and Unstable=US

Table 2: Stability parameters of grain yield for Boro

| Variety | Stability Parameter | | | Stability Index | Stability Rank | Nature of Stability |
|--------------------------|---------------------|--------|-------|-----------------|----------------|---------------------|
| | 2001-2025 | | | | | |
| | S_i | D_i | P_i | G_i | R_i | |
| Non-Aromatic Rice | | | | | | |
| BR 1 | 11.79 | -6.91 | 101 | 0.31 | 43 | BAS |
| BR 2 | 12.50 | -10.07 | 111 | 0.22 | 51 | BAS |
| BR 3 | 10.26 | -1.69 | 116 | 0.61 | 24 | BAS |
| BR 6 | 13.18 | -8.07 | 106 | 0.27 | 48 | BAS |
| BR 7 | 12.94 | -8.55 | 109 | 0.27 | 47 | BAS |
| BR 8 | 13.14 | -5.91 | 106 | 0.35 | 40 | BAS |
| BR 9 | 10.91 | 0.50 | 110 | 0.64 | 23 | BAS |
| BR 12 | 11.19 | -8.66 | 109 | 0.29 | 45 | BAS |
| BR 14 | 9.85 | -1.62 | 111 | 0.56 | 29 | AS |
| BR 15 | 11.31 | 0.42 | 113 | 0.65 | 22 | AS |
| BR 16 | 12.18 | -0.30 | 110 | 0.60 | 25 | AS |
| BR 17 | 20.79 | -13.62 | 97 | -0.03 | 54 | US |
| BR 18 | 10.82 | -8.41 | 107 | 0.28 | 46 | BAS |
| BR 19 | 11.74 | -4.84 | 104 | 0.4 | 38 | BAS |
| BR 26 | 10.85 | -7.65 | 119 | 0.37 | 39 | BAS |
| BRRi dhan27 | 13.39 | -8.44 | 99 | 0.23 | 50 | BAS |
| BRRi dhan28 | 12.31 | -0.66 | 112 | 0.59 | 26 | AS |
| BRRi dhan29 | 10.42 | 11.28 | 112 | 1.08 | 10 | AS |
| BRRi dhan35 | 11.51 | -4.70 | 105 | 0.41 | 37 | BAS |
| BRRi dhan36 | 11.62 | -4.02 | 109 | 0.45 | 35 | BAS |
| BRRi dhan45 | 13.25 | -7.14 | 92 | 0.34 | 42 | BAS |
| BRRi dhan47 | 10.30 | -2.23 | 74 | 0.53 | 32 | AS |
| BRRi dhan55 | 10.19 | 1.44 | 71 | 0.76 | 19 | BAS |
| BRRi dhan58 | 9.95 | 7.20 | 69 | 1.05 | 12 | AS |
| BRRi dhan59 | 12.17 | -2.99 | 62 | 0.53 | 33 | BAS |
| BRRi dhan60 | 11.72 | -1.20 | 59 | 0.57 | 28 | BAS |
| BRRi dhan61 | 9.85 | -3.41 | 61 | 0.54 | 31 | BAS |
| BRRi dhan63 | 9.44 | -4.46 | 47 | 0.44 | 36 | BAS |
| BRRi dhan64 | 13.00 | -9.94 | 45 | 0.15 | 53 | BAS |
| BRRi dhan67 | 10.98 | -2.96 | 57 | 0.58 | 27 | BAS |
| BRRi dhan68 | 9.51 | 1.98 | 52 | 0.75 | 20 | BAS |
| BRRi dhan69 | 9.57 | 3.30 | 51 | 0.79 | 18 | BAS |
| BRRi dhan74 | 10.83 | 5.89 | 48 | 0.85 | 15 | BAS |
| BRRi dhan81 | 11.89 | -10.82 | 35 | 0.2 | 52 | BAS |
| BRRi dhan84 | 11.00 | -7.61 | 30 | 0.27 | 49 | BAS |
| BRRi dhan86 | 9.61 | -9.62 | 40 | 0.35 | 41 | BAS |
| BRRi dhan88 | 9.56 | -2.52 | 35 | 0.55 | 30 | BAS |
| BRRi dhan89 | 10.09 | 15.35 | 32 | 2.02 | 2 | S |
| BRRi dhan92 | 9.89 | 12.12 | 32 | 2.01 | 3 | S |
| BRRi dhan96 | 10.22 | -4.30 | 25 | 0.48 | 34 | BAS |
| BRRi dhan97 | 9.18 | 2.72 | 21 | 0.69 | 21 | BAS |
| BRRi dhan99 | 10.77 | 8.86 | 25 | 1.07 | 11 | AS |
| BRRi dhan100 | 8.49 | 3.44 | 20 | 1.01 | 14 | AS |
| BRRi dhan101 | 7.97 | 7.88 | 13 | 1.04 | 13 | AS |
| BRRi dhan102 | 9.95 | 9.50 | 12 | 0.81 | 17 | BAS |
| BRRi dhan104 | 1.47 | -0.71 | 10 | 1.21 | 7 | AS |
| BRRi dhan105 | 3.34 | 6.60 | 10 | 1.15 | 9 | AS |
| BRRi dhan107 | - | -4.08 | 10 | 0.84 | 16 | BAS |
| BRRi dhan108 | - | 9.02 | 10 | 1.35 | 5 | AS |
| BRRi Hybrid dhan2 | 9.84 | 16.90 | 54 | 1.30 | 6 | AS |
| BRRi Hybrid dhan3 | 10.43 | 17.47 | 63 | 1.37 | 4 | AS |
| BRRi Hybrid dhan5 | 10.79 | 18.60 | 45 | 1.20 | 8 | AS |
| BRRi Hybrid dhan8 | 8.11 | 25.70 | 10 | 2.06 | 1 | S |
| Aromatic Rice | | | | | | |
| BRRi dhan50 | 9.87 | -8.06 | 70 | 0.3 | 44 | BAS |

Note: S=Stable, AS=Average Stable, BAS=Below Average Stable

Table 3: Maximum and minimum yield of BIRRI released rice variety (2001- 2025)

| SL | T.Aman (2001 to 2024) | | | Boro (2001-02 to 2024-2025) | | |
|----|-----------------------|-------------|-------------|-----------------------------|-------------|-------------|
| | Varieties | Max. | Min. | Varieties | Max. | Min. |
| 1 | BR 3 | 6.49 | 0.94 | BR 1 | 8.38 | 1.66 |
| 2 | BR 4 | 6.54 | 0.96 | BR 2 | 7.98 | 1.34 |
| 3 | BR 5 | 6.17 | 0.63 | BR 3 | 8.28 | 2.30 |
| 4 | BR 10 | 7.37 | 1.03 | BR 6 | 9.65 | 1.86 |
| 5 | BR 11 | 8.73 | 0.65 | BR 7 | 8.54 | 2.17 |
| 6 | BR 22 | 6.38 | 1.17 | BR 8 | 9.23 | 1.18 |
| 7 | BR 23 | 6.64 | 0.95 | BR 9 | 8.83 | 2.12 |
| 8 | BR 25 | 6.86 | 1.27 | BR 12 | 8.12 | 2.22 |
| 9 | BIRRI dhan30 | 6.90 | 1.18 | BR 14 | 8.33 | 2.50 |
| 10 | BIRRI dhan31 | 7.00 | 1.20 | BR 15 | 9.77 | 2.06 |
| 11 | BIRRI dhan32 | 7.31 | 1.61 | BR 16 | 8.64 | 1.75 |
| 12 | BIRRI dhan33 | 6.72 | 0.94 | BR 17 | 7.80 | 1.46 |
| 13 | BIRRI dhan34 | 5.91 | 0.68 | BR 18 | 8.36 | 1.34 |
| 14 | BIRRI dhan37 | 6.18 | 0.66 | BR 19 | 8.78 | 1.62 |
| 15 | BIRRI dhan38 | 6.42 | 0.67 | BR 26 | 8.51 | 2.12 |
| 16 | BIRRI dhan39 | 6.77 | 0.85 | BIRRI dhan27 | 7.87 | 1.68 |
| 17 | BIRRI dhan40 | 6.79 | 1.15 | BIRRI dhan28 | 9.65 | 2.28 |
| 18 | BIRRI dhan41 | 6.98 | 0.84 | BIRRI dhan29 | 9.53 | 2.22 |
| 19 | BIRRI dhan44 | 6.75 | 1.49 | BIRRI dhan35 | 8.47 | 1.53 |
| 20 | BIRRI dhan46 | 6.84 | 1.45 | BIRRI dhan36 | 9.22 | 2.40 |
| 21 | BIRRI dhan49 | 7.60 | 2.15 | BIRRI dhan45 | 8.53 | 1.83 |
| 22 | BIRRI dhan51 | 7.25 | 1.00 | BIRRI dhan47 | 7.98 | 2.24 |
| 23 | BIRRI dhan52 | 8.07 | 2.13 | BIRRI dhan50 | 7.80 | 2.15 |
| 24 | BIRRI dhan53 | 6.63 | 1.76 | BIRRI dhan55 | 11.24 | 2.26 |
| 25 | BIRRI dhan54 | 7.00 | 1.66 | BIRRI dhan58 | 9.67 | 3.18 |
| 26 | BIRRI dhan56 | 6.46 | 1.23 | BIRRI dhan59 | 8.32 | 1.97 |
| 27 | BIRRI dhan57 | 5.59 | 1.00 | BIRRI dhan60 | 9.92 | 2.52 |
| 28 | BIRRI dhan62 | 5.54 | 0.76 | BIRRI dhan61 | 8.17 | 3.13 |
| 29 | BIRRI dhan66 | 6.69 | 1.41 | BIRRI dhan63 | 9.30 | 3.29 |
| 30 | BIRRI dhan70 | 6.30 | 1.72 | BIRRI dhan64 | 8.16 | 2.25 |
| 31 | BIRRI dhan71 | 7.07 | 1.40 | BIRRI dhan67 | 10.47 | 3.49 |
| 32 | BIRRI dhan72 | 7.41 | 1.85 | BIRRI dhan68 | 9.22 | 3.64 |
| 33 | BIRRI dhan73 | 6.93 | 1.36 | BIRRI dhan69 | 8.89 | 3.60 |
| 34 | BIRRI dhan75 | 6.61 | 1.27 | BIRRI dhan74 | 9.10 | 3.67 |
| 35 | BIRRI dhan76 | 6.22 | 0.97 | BIRRI dhan81 | 7.76 | 3.00 |
| 36 | BIRRI dhan77 | 6.39 | 1.52 | BIRRI dhan84 | 9.70 | 3.25 |
| 37 | BIRRI dhan78 | 6.36 | 1.98 | BIRRI dhan86 | 8.21 | 3.56 |
| 38 | BIRRI dhan79 | 6.34 | 2.32 | BIRRI dhan88 | 9.06 | 4.05 |
| 39 | BIRRI dhan80 | 6.25 | 2.36 | BIRRI dhan89 | 9.37 | 3.95 |
| 40 | BIRRI dhan87 | 7.14 | 1.90 | BIRRI dhan92 | 9.22 | 3.52 |
| 41 | BIRRI dhan90 | 5.12 | 1.35 | BIRRI dhan96 | 8.24 | 3.79 |
| 42 | BIRRI dhan91 | 5.14 | 1.11 | BIRRI dhan97 | 8.50 | 3.73 |
| 43 | BIRRI dhan93 | 6.74 | 2.44 | BIRRI dhan99 | 9.68 | 4.11 |
| 44 | BIRRI dhan94 | 6.65 | 2.50 | BIRRI dhan100 | 10.14 | 4.08 |
| 45 | BIRRI dhan95 | 6.39 | 2.34 | BIRRI dhan101 | 9.48 | 4.48 |
| 46 | BIRRI dhan103 | 7.15 | 2.57 | BIRRI dhan102 | 8.88 | 3.75 |
| 47 | BIRRI Hybrid dhan4 | 6.58 | 1.16 | BIRRI dhan104 | 8.44 | 4.64 |
| 48 | BIRRI Hybrid dhan6 | 6.95 | 0.95 | BIRRI dhan105 | 9.42 | 4.86 |
| 49 | - | - | - | BIRRI dhan107 | 9.19 | 4.34 |
| 50 | - | - | - | BIRRI dhan108 | 8.65 | 5.05 |
| 51 | - | - | - | BIRRI Hybrid dhan2 | 9.87 | 3.73 |
| 52 | - | - | - | BIRRI Hybrid dhan3 | 9.70 | 3.02 |
| 53 | - | - | - | BIRRI Hybrid dhan5 | 9.76 | 4.46 |
| 54 | - | - | - | BIRRI Hybrid dhan8 | 10.34 | 4.61 |
| | Average | 6.67 | 1.39 | Average | 8.96 | 2.91 |

Conclusion

T. Aman varieties, BRR1 dhan49, BRR1 dhan87, BRR1 dhan103 and BRR1 hybrid dhan6 were found stable. The variety BRR1 dhan91 were found to be unstable during T. Aman season. Among the aromatic rice BRR1 dhan5, BRR1 dhan34, BRR1 dhan37 and BRR1 dhan38 were found as below average stable in T. Aman season. Boro varieties, BRR1 dhan89, BRR1 dhan92 and BRR1 hybrid dhan8 were found stable. The variety BR17 were found to be unstable during Boro season. BR14, BR15, BR16, BRR1 dhan28, BRR1 dhan29, BRR1 dhan47, BRR1 dhan58, BRR1 dhan99, Bangabandhu dhan100, BRR1 dhan101, BRR1 dhan104, BRR1 dhan105, BRR1 dhan108, BRR1 hybrid dhan2, BRR1 hybrid dhan3 and BRR1 hybrid dhan5 varieties were found as average stable and rest of the 33 varieties appeared to be below average stable. On the other hand, only aromatic rice varieties BRR1 dhan50 appeared to average stable. In T. Aman varieties the average maximum and minimum yield was observed 6.60 t/ha and 1.55 t/ha respectively. The average maximum and minimum yield were observed 8.51 t/ha and 2.75 t/ha respectively in Boro varieties.

Project 2: Multivariate analysis of BRR1 varieties

Activity 2.1: Genotype X Environment Interaction of BRR1 Varieties

(In collaboration with Pl. Breeding Div., ARD Regional Stations)

-Md. Abdullah Al Mamun, Md. Ismail Hossain, Niaz Md. Farhat Rahman, Md. Abdul Qayum, Md. Abdullah Aziz, Md. Asadullah and One Scientist from each Regional Station

Introduction

Rice is the main staple food in Bangladesh, occupies nearly 80% of the total net cropped area (Hossain *et.al*, 2015). Development and adaptation of high yielding cultivars under wide range of diversified environments is one of the major goals for the plant breeders in crop improvement programme (Boseet.al, 2015). The development of rice varieties is affected by the environment, genotype and their interaction. Yield performance of different varieties varies across testing environments and its grain yield performance is a function of genotype (G), environment (E) and genotype \times environment interaction (GEI). The structure of GEI is very important in plant breeding programs because a significant GEI can seriously impair efforts in selection of superior genotypes in relation to new crop introductions and cultivar development programs leads to successful evaluation of stable genotype, which could be used for general cultivation (Yan and Racjan, 2002; Vassgas et al. 2001; Reza et al.2007).

Objective

The major objective of the study was to identify BRR1 released rice genotypes that have both high mean yield and stable yield performance across different environments for different ecosystem of Bangladesh.

Materials and Methods

The experiment was conducted in multi-environment trials for T. Aman 2024. Forty-eight (48) BRR1 released T. Aman rice varieties were evaluated in nine environmental conditions of Bangladesh, such as Barishal, Bhanga, Gazipur, Kushtia, Rajshahi, Rangpur and Sonagazi. The experimental sites covered all ecosystems of Bangladesh. The experiments were carried out in randomized complete block design (RCBD) with three replications and evaluated for rice grain yield. Each experimental plot comprised of 3m \times 2m. Standard agronomic practices were followed and plant protection measures were taken according to Adhunik dhaner chash, BRR1 (2024). AMMI model was used to quantify the effect of different factors (genotype, location) of the experiment. The model further provides graphical representation of the numerical results (GGE biplot analysis) with a straight-forward interpretation of the underlying causes of $G \times E$.

Results and discussion

ANOVA of combined analysis

The combined analysis revealed that the yield of rice genotypes was significantly influenced by the environment and contributed 48.78, 23.86, and 19.02% of the total variation for medium, short, and long duration, respectively, in the Aman season. Additionally, the relative contribution of the genotype sum of squares was found to be 39.37, 27.71, and 18.19% for long, short, and medium duration, respectively. Genotype by environment ($G \times E$) contributed the most 36.75% to the total variation for short duration, followed by 28.23% and 20.20% for long and medium duration (Table 4). Greater portion of the total variation was explained by the environmental main effect, indicating that the environments were diverse and a major part of the variation in grain yield was reflected by environmental changes. The highly significant genotype \times environment interaction effects for grain yield confirmed that genotypes responded differently to the variation in environmental conditions.

Table 4. ANOVA of individual category (long, medium and short duration) Aman 2023.

| SV | Long duration | | | Medium duration | | | Short duration | | |
|---------------------|---------------|---------|--------|-----------------|---------|--------|----------------|---------|--------|
| | DF | MS | SS (%) | DF | MS | SS (%) | DF | MS | SS (%) |
| ENV | 6 | 11.75** | 19.02 | 6 | 26.70** | 48.78 | 6 | 11.59** | 23.86 |
| REP(ENV) | 14 | 0.19 | 0.74 | 14 | 0.26 | 1.15 | 14 | 1.20 | 0.87 |
| GEN | 17 | 8.58** | 39.37 | 13 | 4.59** | 18.19 | 15 | 5.38** | 27.71 |
| ENV: GEN | 102 | 1.02** | 28.23 | 78 | 0.85** | 20.20 | 90 | 1.19** | 36.75 |
| Residuals | 238 | 0.19 | 12.64 | 182 | 0.21 | 11.68 | 210 | 0.14 | 10.80 |
| CV (%) | 11.29 | | | 10.01 | | | 8.12 | | |
| LSD _{0.05} | 0.65 | | | 0.69 | | | 0.54 | | |

Note: ENV=environment, GEN= genotype, DF = degrees of freedom; MS = mean sum square; SS (%) = explain % sum of squares; ** = significant at 1% level.

Performance and stability of rice genotypes across tested environments

The GGE biplot explained 82.91%, 78.85%, and 69.11% of the total variation of the environments for long, medium and short duration respectively (Fig. 1-3). Within a single mega-environment, genotypes should be evaluated on both mean performance and stability across environments. Figures 1a, 2a and 3a shows average-environment coordination (AEC) views of the GGE biplot for grain yield of long, medium, and short duration. In long duration, BRRI dhan44 recorded the highest average grain yield (4.59 t/ha), with BR11 and BR22 identified as the most stable and ideal genotypes (Fig. 1a). For medium duration, genotypes like BRRI dhan103, BRRI dhan93 and BRRI dhan94 were highly stable, producing above-average yields (Fig. 2a). In short duration, BRRI dhan87, BRRI Hybrid dhan6 and BRRI dhan72 showed high yields and stability, making them the most suitable genotypes for these conditions. (Fig. 3a).

Identification of which-won-where and mega-environment

One of the most attractive features of a GGE biplot is its ability to show the which-won-where pattern of a genotype by environment dataset. This plot consists of a polygon with perpendicular lines, called equality lines, drawn onto its sides. These lines divide the polygon into various sectors. Genotypes located on the vertices of the polygon are the best performers in one or more environments falling within a particular sector. The GGE biplot revealed distinct mega-environments for each duration type. In long duration, two mega-environments were identified, where BRRI dhan44, BR11 and BR10 were the top-performing genotypes (Fig. 1b). For medium duration, the analysis divided the environments into three mega-environments, with BRRI dhan94, BRRI dhan103, and BRRI dhan52 as the winning genotypes in different regions. First mega-environmental locations were Kushtia, Bhanga, and Rajshahi the winning genotype in those environments was BRRI dhan103 and Barishal and Rangpur second mega environment and BRRI dhan93 winning genotype (Fig. 2b). For short duration, three mega-environments emerged, with BRRI dhan72, BRRI dhan87, BRRI dhan66, and BRRI Hybrid dhan6 leading in performance across various locations (Fig. 3b). First mega-environmental locations were Bhanga, Barishal and Kushtia with BRRI dhan87 being the winning genotypes. Second mega environment were Gazipur and Rajshahi.

Evaluation of test environments

For long duration, Rangpur was identified as the most representative and ideal testing environment (Fig. 1c). In medium duration, Rajshahi stood out as optimal environments for genotype evaluation due to their discriminating ability and representativeness (Fig. 2c). In short duration, Kushtia was considered highly representative, making them ideal environments for testing short-duration genotypes (Fig. 3c). The analysis highlighted that environments like Rangpur and Kushtia, with longer vectors, were more discriminating, offering valuable insights into genotype performance.

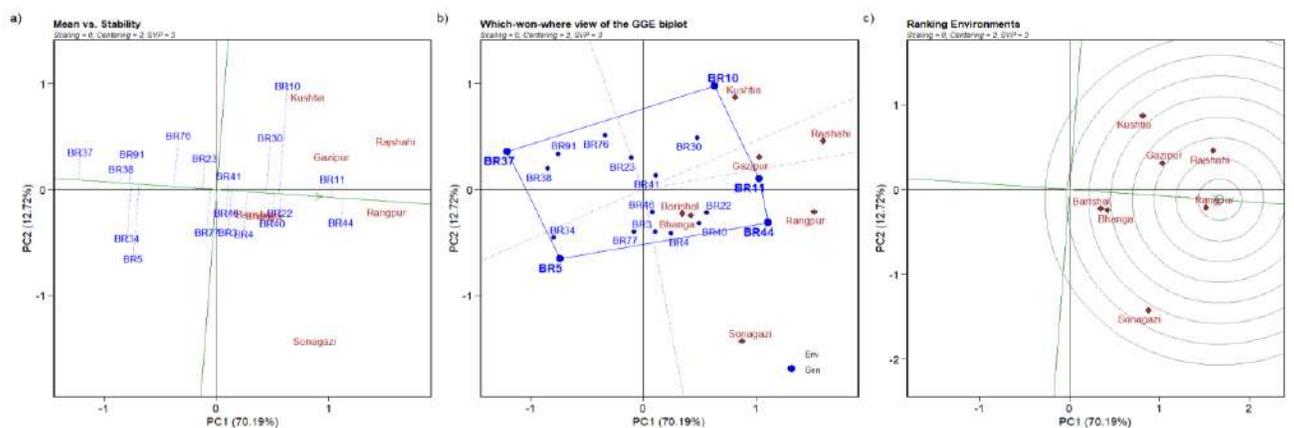


Fig. 1: GGE biplot of mean and stability (a), GGE biplot identification of winning genotypes and their related mega-environments (b) and association among the test environments (c) of long duration rice genotypes for yield and specific genotype × environment interactions in T. Aman 2024.

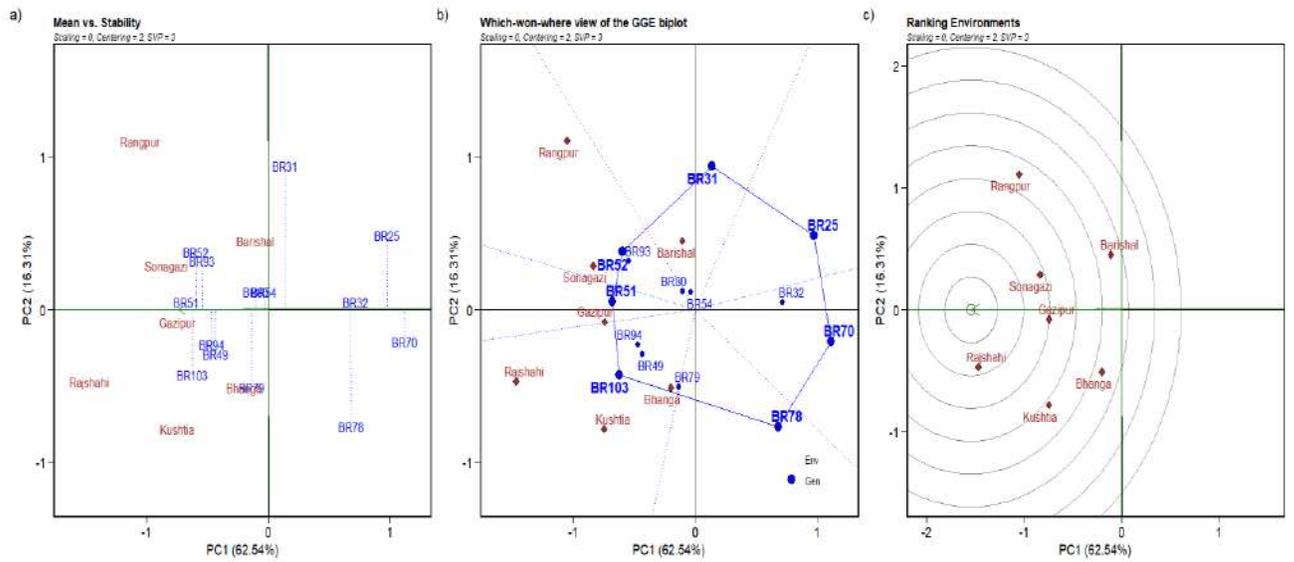


Fig. 2: GGE biplot of mean and stability (a), GGE biplot identification of winning genotypes and their related mega-environments (b) and association among the test environments (c) of medium duration rice genotypes for yield and specific genotype × environment interactions in T. Aman 2024.

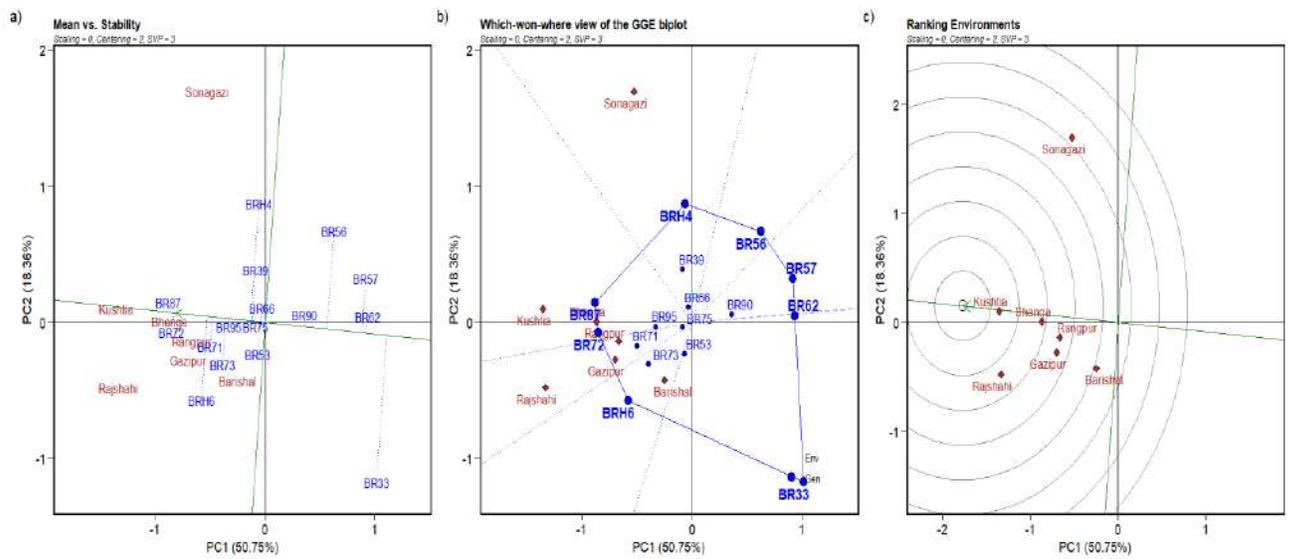


Fig. 3: GGE biplot of mean and stability (a), GGE biplot identification of winning genotypes and their related mega-environments (b) and association among the test environments (c) of short duration rice genotypes for yield and specific genotype × environment interactions in T. Aman 2024.

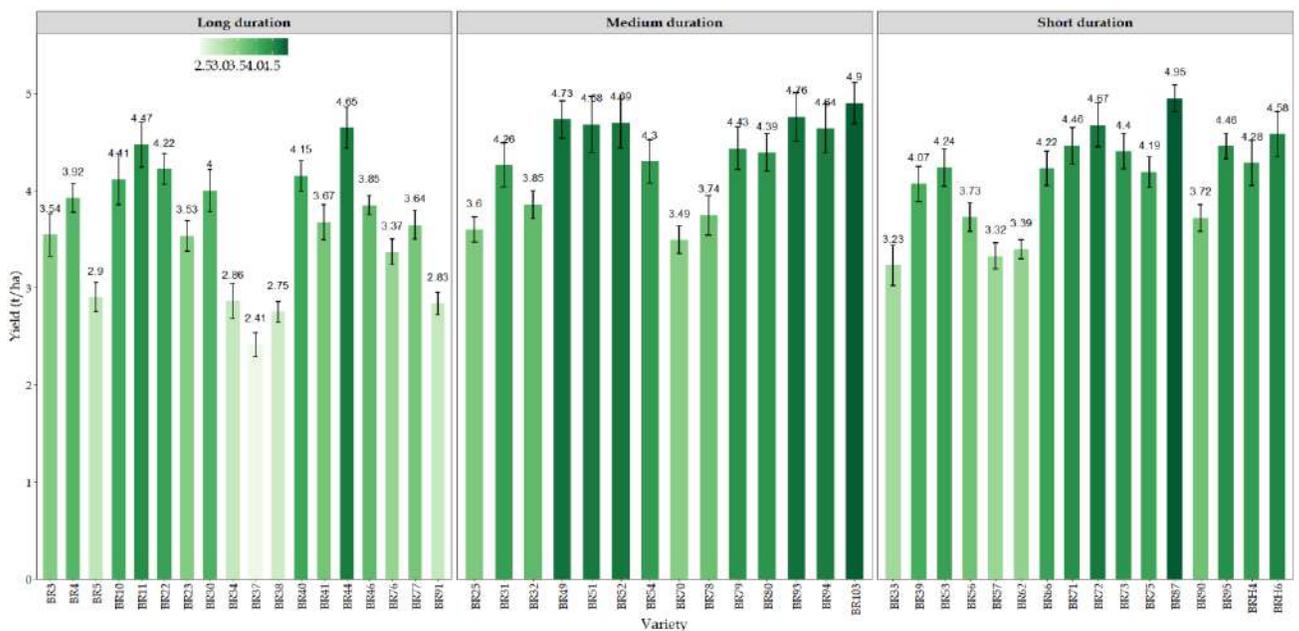


Fig. 4: Grain yield performance of BIRRI released T. Aman rice varieties during 2024.

Conclusion

The highly significant genotype \times environment interaction effects for grain yield confirmed that genotypes responded differently to the variation in environmental conditions for long, medium, and short-duration Aman varieties. The greater portion of the total variation was explained by the environmental main effect, indicating that the environments were diverse and a major part of the variation in grain yield was reflected by environmental changes. In the Aman season, BR11 and BRR1 dhan44 recorded the highest average grain yield and ideal genotypes among long-duration varieties. BRR1 dhan103, BRR1 dhan94, and BRR1 dhan93 were the most stable genotypes with above-average yield in medium duration, where BRR1 dhan87, BRR1 dhan72, and BRR1 Hybrid dhan6 were the most stable genotypes and above average yielder for short duration.

Project 3: Rice and Rice Related Database

Activity 3.1 Rice database and analysis system (RDAS)

- Md. Ismail Hossain, Niaz Md. Farhat Rahman, Md. Abdul Qayum,
Md. Abdullah Aziz, Md. Abdullah Al Mamun and Md. Asadullah

Introduction:

As staple food, rice plays a crucial role in ensuring food security in Bangladesh. Database is a strong tool for research and policy. Agricultural Statistics Division of BRR1 has been collecting, generating, managing and providing various rice and rice related data in BRR1 website. This database needs more informative and user friendly. User need a database where data collection is very easy and quick also data can be extracted as per user desire format.

Objectives

- To develop a web based integrated framework on 'Rice Database and Analysis System (RDAS)
- To create map and graph based on rice and rice related data.

Materials and Method

Methodology

An automated informative and user-friendly rice database and analysis system (RDAS) were developed for processing, assessing and validating rice data (area, production and yield) and related data (temperature, rainfall etc.) and it was linked in Rice Databased service menu of BRR1 website for dissemination the operational service to the stakeholders. That will contribute significantly to rice research and development. For RDAS following programming and scripting Languages were used-

- R script (3.5.1)
 - For analytical processing
- Python (v3.7)
 - For backend processing.
- PHP (v7.1)
 - Front end application
- Java script (ES2015)
 - For plotting and frontend application
- Grads
- Bash Scripting
 - For system Integration

Results and Discussion

A user-friendly web-based application was developed with graphical interface, were need with minimal technical expertise. For graphical view, regularly updating the rice and weather database. Some climate data were manually inputted in the system. The system supports continuous data inflow and generates more information about rice and climate graphically.

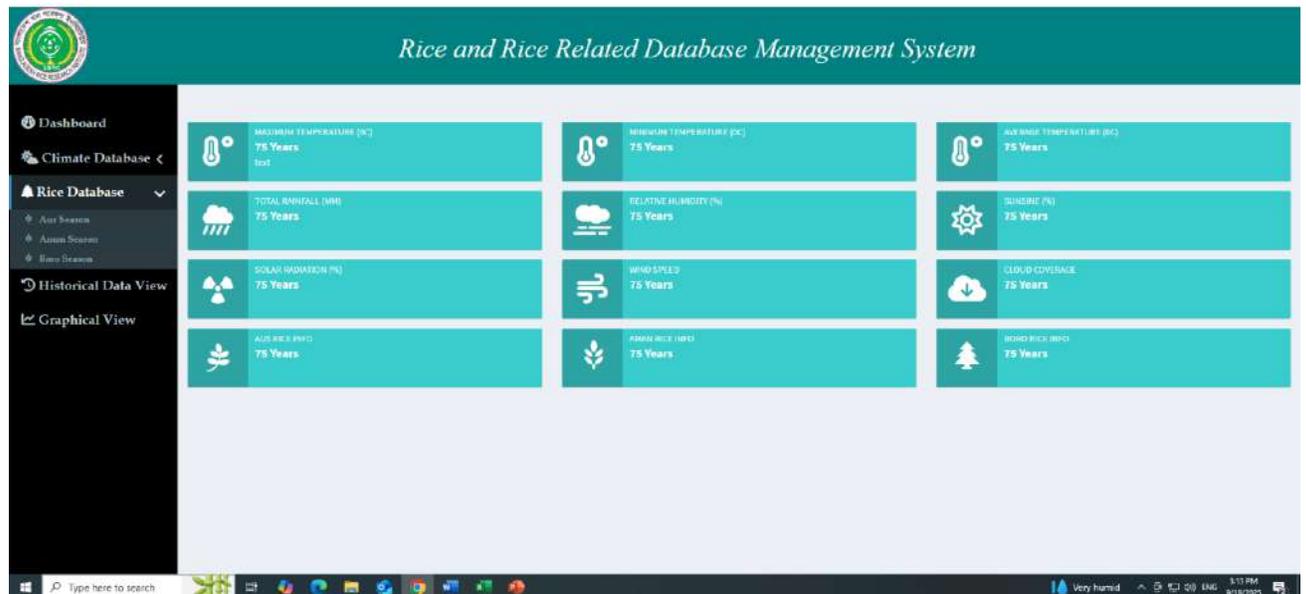


Fig. 5: Rice and Rice related Dashboard

Conclusion

RDAS is a tool to preserve and delivered the rice data management and analysis by offering a centralized, interactive, and analytical platform. By integrating multiple types of rice and rice related information and providing intuitive visualization tools, RDAS will make a significant contribution to the advancement of rice research and the development of smart agriculture. The web-based application successfully integrates multiple datasets and graphical interface. Primary data were inserted in different categories including rice and weather patterns data.

Activity 3.2: Maintenance of rice and related database

- Md. Ismail Hossain, Niaz Md. Farhat Rahman, Md. Abdul Qayum,
Md. Abdullah Aziz, Md. Abdullah Al Mamun and Md. Asadullah

Objectives

1. To maintain up-to-date computerized information on rice and related crops
2. To provide rice and related information to other research divisions and interested persons.

Methodology

Secondary data on rice and other important crops were collected periodically from Bangladesh Bureau of Statistics (BBS), Agricultural Marketing Directorate, Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), Bangladesh Agricultural Development Corporation (BADC) and other sources periodically and computerized. We have initiated a database system where we used updated software and database program. To make this database, we were used **SQL Server** 2005 express edition/2008/2010/2012 version and **Oracle** 9i/10g/11i version.

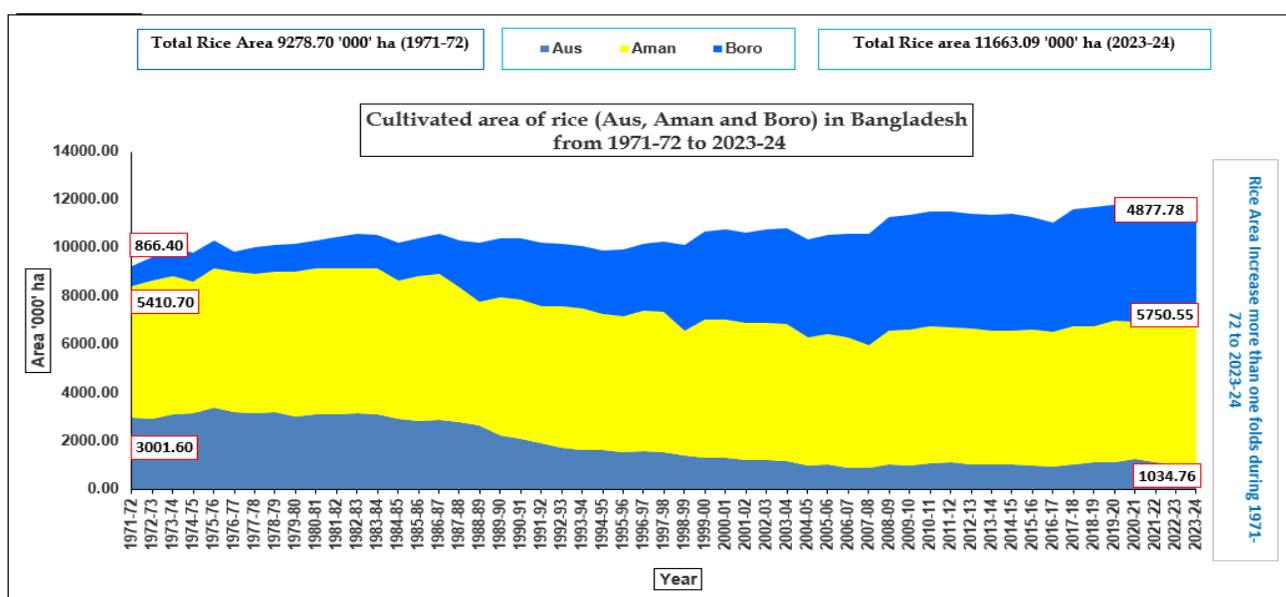
Results

Existing databases have been updated. After necessary correction the data were analysed and the output were available in BIRRI website in different form under different scenarios. Using the time series data (area and production data from 1971-72 to 2023-24) we produced rice cultivated area and production graph of Bangladesh (Graph 1 & Graph 2). Rice area increased about more than one folds but the production increased about four folds during 1971-72 to 2023-24. Rice area growth rate was 3.96 in year 1972-73 but in 2023-24 is 0.23 (Table 5). Similarly, growth rate of rice production was 1.30 in year 1972-73 but in 2023-24 is 4.10 (Table 6). Besides using the rice and related database, created a Data Leadership Dashboard System. Which is uploaded in internal e-service menu of BIRRI website. From which one can see and know at a glance the region and variety wise performance of BIRRI developed rice varieties.

Table 5. Rice area ('000'ha) growth rate in Bangladesh from 1971-72 to 2023-24

| Year | Season | | | Total Area (ha.) | GR (%) |
|---------|---------|---------|---------|------------------|--------|
| | Aus | Aman | Boro | | |
| 1971-72 | 3001.60 | 5410.70 | 866.40 | 9278.70 | - |
| 1972-73 | 2930.00 | 5713.80 | 1002.60 | 9646.40 | 3.96 |
| 1973-74 | 3107.90 | 5718.70 | 1222.70 | 10049.30 | 4.18 |
| 1974-75 | 3179.10 | 5449.90 | 1161.20 | 9790.20 | -2.58 |
| 1975-76 | 3419.90 | 5759.90 | 1147.90 | 10327.70 | 5.49 |
| 1976-77 | 3217.10 | 5806.40 | 854.20 | 9877.70 | -4.36 |
| 1977-78 | 3161.70 | 5771.20 | 1093.70 | 10026.60 | 1.51 |
| 1978-79 | 3234.60 | 5805.10 | 1071.80 | 10111.50 | 0.85 |
| 1979-80 | 3036.30 | 5972.70 | 1148.40 | 10157.40 | 0.45 |
| 1980-81 | 3111.20 | 6035.80 | 1160.00 | 10307.00 | 1.47 |
| 1981-82 | 3145.60 | 6010.30 | 1301.70 | 10457.60 | 1.46 |
| 1982-83 | 3158.10 | 5993.00 | 1432.80 | 10583.90 | 1.21 |
| 1983-84 | 3138.70 | 6006.70 | 1401.20 | 10546.60 | -0.35 |
| 1984-85 | 2937.60 | 5710.20 | 1574.40 | 10222.20 | -3.08 |
| 1985-86 | 2844.90 | 6018.90 | 1533.20 | 10397.00 | 1.71 |
| 1986-87 | 2903.60 | 6052.40 | 1651.70 | 10607.70 | 2.03 |
| 1987-88 | 2788.30 | 5590.40 | 1942.60 | 10321.30 | -2.70 |
| 1988-89 | 2683.46 | 5100.80 | 2438.30 | 10222.56 | -0.96 |
| 1989-90 | 2255.00 | 5702.50 | 2453.60 | 10411.10 | 1.84 |
| 1990-91 | 2107.30 | 5775.30 | 2547.90 | 10430.50 | 0.19 |
| 1991-92 | 1915.90 | 5692.30 | 2634.90 | 10243.10 | -1.80 |
| 1992-93 | 1735.10 | 5843.70 | 2598.90 | 10177.70 | -0.64 |
| 1993-94 | 1649.40 | 5843.30 | 2580.80 | 10073.50 | -1.02 |
| 1994-95 | 1663.75 | 5594.17 | 2663.54 | 9921.46 | -1.51 |
| 1995-96 | 1541.85 | 5646.40 | 2753.57 | 9941.82 | 0.21 |
| 1996-97 | 1592.29 | 5802.49 | 2782.59 | 10177.37 | 2.37 |
| 1997-98 | 1565.88 | 5808.45 | 2888.56 | 10262.89 | 0.84 |
| 1998-99 | 1424.26 | 5165.50 | 3526.67 | 10116.43 | -1.43 |
| 1999-00 | 1351.32 | 5704.87 | 3651.89 | 10708.08 | 5.85 |
| 2000-01 | 1325.23 | 5709.96 | 3761.84 | 10797.03 | 0.83 |
| 2001-02 | 1242.18 | 5647.22 | 3771.34 | 10660.74 | -1.26 |
| 2002-03 | 1243.72 | 5682.11 | 3844.84 | 10770.67 | 1.03 |
| 2003-04 | 1202.58 | 5677.61 | 3943.50 | 10823.69 | 0.49 |
| 2004-05 | 1024.68 | 5279.92 | 4063.79 | 10368.39 | -4.21 |
| 2005-06 | 1034.27 | 5429.01 | 4065.81 | 10529.09 | 1.55 |
| 2006-07 | 905.71 | 5415.62 | 4250.10 | 10571.43 | 0.40 |
| 2007-08 | 918.66 | 5048.16 | 4607.85 | 10574.67 | 0.03 |
| 2008-09 | 1065.56 | 5497.77 | 4716.31 | 11279.64 | 6.67 |
| 2009-10 | 984.22 | 5662.89 | 4706.60 | 11353.71 | 0.66 |
| 2010-11 | 1112.87 | 5645.64 | 4770.00 | 11528.51 | 1.54 |
| 2011-12 | 1138.00 | 5580.00 | 4810.00 | 11528.00 | 0.00 |
| 2012-13 | 1053.00 | 5610.00 | 4760.00 | 11423.00 | -0.91 |
| 2013-14 | 1051.00 | 5530.20 | 4790.00 | 11371.20 | -0.45 |
| 2014-15 | 1045.00 | 5530.00 | 4846.00 | 11421.00 | 0.44 |
| 2015-16 | 1025.00 | 5590.40 | 4685.10 | 11300.50 | -1.06 |
| 2016-17 | 941.70 | 5583.30 | 4547.30 | 11072.30 | -2.02 |
| 2017-18 | 1075.10 | 5679.50 | 4859.40 | 11614.00 | 4.89 |
| 2018-19 | 1145.13 | 5621.90 | 4909.85 | 11676.88 | 0.54 |
| 2019-20 | 1134.00 | 5883.80 | 4754.40 | 11772.20 | 0.82 |
| 2020-21 | 1304.99 | 5625.90 | 4872.60 | 11803.49 | 0.27 |
| 2021-22 | 1159.02 | 5719.02 | 4813.74 | 11691.78 | -0.95 |
| 2022-23 | 1061.09 | 5723.47 | 4851.78 | 11636.34 | -0.47 |
| 2023-24 | 1034.76 | 5750.55 | 4877.78 | 11663.09 | 0.23 |

Sources: BBS and DAE

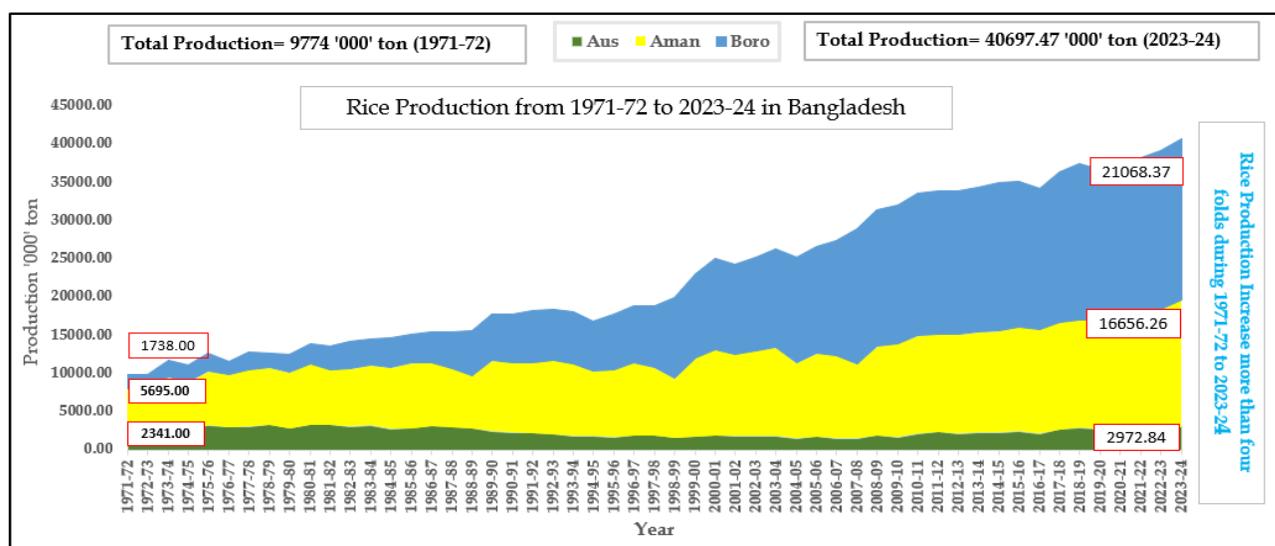


Graph 1: Cultivated area of Rice (Aus, Aman and Boro) in Bangladesh from 1971-72 to 2023-24

Table 6. Rice production (000'm.ton) growth rate in Bangladesh from 1971-72 to 2023-24

| Year | Season | | | Total Production | GR(%) |
|---------|---------|-----------|----------|------------------|-------|
| | Aus | Aman | Boro | | |
| 1971-72 | 2341.00 | 5695.00 | 1738.00 | 9774.00 | - |
| 1972-73 | 2243.00 | 5587.00 | 2071.00 | 9901.00 | 1.30 |
| 1973-74 | 2801.00 | 6699.00 | 2220.00 | 11720.00 | 18.37 |
| 1974-75 | 2859.00 | 6000.00 | 2250.00 | 11109.00 | -5.21 |
| 1975-76 | 3229.00 | 7045.00 | 2286.00 | 12560.00 | 13.06 |
| 1976-77 | 3014.00 | 6905.00 | 1650.00 | 11569.00 | -7.89 |
| 1977-78 | 3103.00 | 7422.00 | 2239.00 | 12764.00 | 10.33 |
| 1978-79 | 3287.00 | 7429.00 | 1929.00 | 12645.00 | -0.93 |
| 1979-80 | 2809.00 | 7303.00 | 2427.00 | 12539.00 | -0.84 |
| 1980-81 | 3289.00 | 7964.00 | 2630.00 | 13883.00 | 10.72 |
| 1981-82 | 3270.00 | 7209.00 | 3152.00 | 13631.00 | -1.82 |
| 1982-83 | 3065.00 | 7516.00 | 3548.00 | 14129.00 | 3.65 |
| 1983-84 | 3222.00 | 7843.00 | 3350.00 | 14415.00 | 2.02 |
| 1984-85 | 2783.00 | 7930.00 | 3909.00 | 14622.00 | 1.44 |
| 1985-86 | 2828.00 | 8542.00 | 3671.00 | 15041.00 | 2.87 |
| 1986-87 | 3130.00 | 8267.00 | 4010.00 | 15407.00 | 2.43 |
| 1987-88 | 2993.00 | 7690.00 | 4731.00 | 15414.00 | 0.05 |
| 1988-89 | 2856.00 | 6857.00 | 5831.00 | 15544.00 | 0.84 |
| 1989-90 | 2475.00 | 9202.00 | 6033.00 | 17710.00 | 13.93 |
| 1990-91 | 2261.00 | 9167.00 | 6357.00 | 17785.00 | 0.42 |
| 1991-92 | 2179.00 | 9269.00 | 6807.00 | 18255.00 | 2.64 |
| 1992-93 | 2075.00 | 9680.00 | 6586.00 | 18341.00 | 0.47 |
| 1993-94 | 1850.20 | 9419.20 | 6772.20 | 18041.60 | -1.63 |
| 1994-95 | 1790.70 | 8504.00 | 6538.70 | 16833.40 | -6.70 |
| 1995-96 | 1676.00 | 8790.00 | 7220.60 | 17686.60 | 5.07 |
| 1996-97 | 1870.00 | 9551.00 | 7460.00 | 18881.00 | 6.75 |
| 1997-98 | 1874.60 | 8849.80 | 8137.30 | 18861.70 | -0.10 |
| 1998-99 | 1616.90 | 7735.80 | 10551.90 | 19904.60 | 5.53 |
| 1999-00 | 1734.00 | 10306.00 | 11027.00 | 23067.00 | 15.89 |
| 2000-01 | 1916.00 | 11249.00 | 11920.50 | 25085.50 | 8.75 |
| 2001-02 | 1808.00 | 10726.00 | 11766.00 | 24300.00 | -3.13 |
| 2002-03 | 1850.70 | 11118.40 | 12222.20 | 25191.30 | 3.67 |
| 2003-04 | 1831.80 | 11520.50 | 12837.10 | 26189.40 | 3.96 |
| 2004-05 | 1500.00 | 9819.00 | 13837.10 | 25156.10 | -3.95 |
| 2005-06 | 1745.00 | 10810.00 | 13975.30 | 26530.30 | 5.46 |
| 2006-07 | 1512.00 | 10841.00 | 14965.00 | 27318.00 | 2.97 |
| 2007-08 | 1507.00 | 9662.00 | 17762.00 | 28931.00 | 5.90 |
| 2008-09 | 1895.00 | 11613.00 | 17809.00 | 31317.00 | 8.25 |
| 2009-10 | 1709.00 | 12207.00 | 18059.00 | 31975.00 | 2.10 |
| 2010-11 | 2132.82 | 12791.00 | 18616.00 | 33539.82 | 4.89 |
| 2011-12 | 2333.00 | 12798.00 | 18783.00 | 33914.00 | 1.12 |
| 2012-13 | 2158.00 | 12897.00 | 18778.00 | 33833.00 | -0.24 |
| 2013-14 | 2326.00 | 13023.30 | 19007.00 | 34356.30 | 1.55 |
| 2014-15 | 2328.00 | 13190.20 | 19343.00 | 34861.20 | 1.47 |
| 2015-16 | 2468.00 | 13591.40 | 19001.10 | 35060.50 | 0.57 |
| 2016-17 | 2133.60 | 13656.00 | 18411.80 | 34201.40 | -2.45 |
| 2017-18 | 2709.70 | 13993.80 | 19575.80 | 36279.30 | 6.08 |
| 2018-19 | 2920.20 | 14054.90 | 20388.50 | 37363.60 | 2.99 |
| 2019-20 | 2755.39 | 14203.19 | 19645.33 | 36603.91 | 3.56 |
| 2020-21 | 3284.71 | 14437.76 | 19885.28 | 37607.75 | 2.74 |
| 2021-22 | 3000.08 | 14958.39 | 20185.94 | 38144.41 | 1.43 |
| 2022-23 | 2901.15 | 15426.395 | 20767.62 | 39095.17 | 2.49 |
| 2023-24 | 2972.84 | 16656.26 | 21068.37 | 40697.47 | 4.10 |

Sources: BBS and DAE



Graph 2: Rice Production (Aus, Aman and Boro) in Bangladesh from 1971-72 to 2023-24

Conclusion

Rice area increased about more than one folds but the production increased about four folds during 1971-72 to 2023-24. Although the growth rate of rice area was 3.96 in year 1972-73 but in 2023-24 is 0.23. Similarly, growth rate of rice production was 1.30 in year 1972-73 but in 2023-24 is 4.10. Moreover, rice and related data have been updating regularly and the collected data are being available in BIRRI website. Also, being producing different types of graphs, trend and climatic map of Bangladesh by using the database as per requirement of BIRRI authority and BIRRI scientists.

Project 4: Utilization of geographical information system (GIS) in rice research

Activity 4.1: Suitability Mapping of BRRI released varieties (BRRI dhan103 to BRRI dhan106)

(In collaboration with Plant Breeding Div., Soil Science Div. and ARD)

- Md. Abdullah Aziz, Dr. Biswajit Karmaker, Md. Ismail Hossain, Niaz Md. Farhat Rahman, Md. Abdul Qayum and Md. Abdullah Al Mamun

Introduction

Bangladesh agriculture involves food production for 163.65 million people from merely 8.75 million hectares of agricultural land (Salam *et al.*, 2014). More food will be required in future because of increasing population as well as decreasing resources (e.g. land, labour, soil health and water), and increasing climate vulnerability (e.g., drought, salinity, flood, heat and cold) appeared as the great challenges to keep the pace of food production in the background of increasing population. Sufficient rice production is the key to ensure food security in Bangladesh. In fact, Rice security is synonymous to “Food security” in Bangladesh as in many other rice growing countries (Brolley, 2015). We have very limited amount of land resource, moreover 0.4% rice land is reducing every year (The daily Prothom-Alo, 2015). Thus, we need to best use of limited land resource. Our land is not homogenous all over the Bangladesh. Various physical and chemical properties of soil varies spatially, on the other hand various rice varieties are suitable for some specific physical and chemical properties. As we need to high production with limited land, so it was very helpful if we have variety wise suitability map based on soil properties BRRI dhan103 to BRRI dhan106 varieties are prospective varieties. So, these varieties land suitability maps are very important.

Objectives

1. To construct suitability map of BRRI released rice varieties.

Methodology

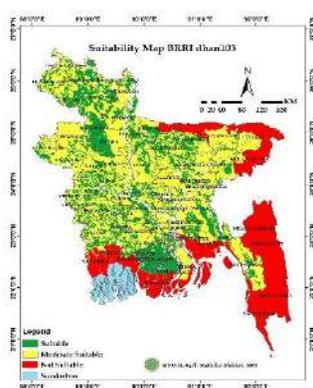
Soil physical properties and climatic parameter maps (shape file) were considered to determine suitable growing area for particular rice varieties. The suitability scale category 1 to 3 was assigned to each soil characteristic in relation to particular rice varieties cultivation by the recommendation of relevant expert. Input vector themes soil physical properties were converted into grid themes for analysis in the Model Builder environment using ArcGIS10.1 Spatial Analyst Module. Then each input grid was weighted by the relative influence for suitability assessment. These weights were the values of "Percent Influence Field" in the weighted overlay table of the Model Builder. Finally, the suitability map was generated.

Results and Discussion

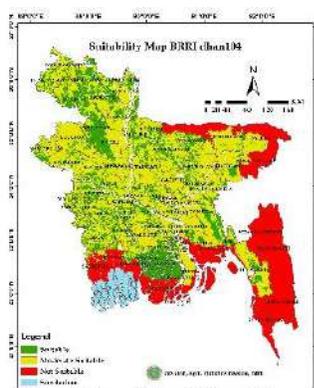
Boro Season: In Boro season, suitable area for BRRI dhan104 is higher than BRRI dhan105. BRRI dhan104 variety mainly suitable in all over of Bangladesh but BRRI dhan105 is suitable in north-east part. Map 2,3 shows the suitability map of BRRI dhan104 and BRRI dhan105 respectively.

Aman Season: In Aman season, BRRI dhan103 is appropriate for north-west and some part of central southern area. Map 1 shows the suitability map of BRRI dhan103.

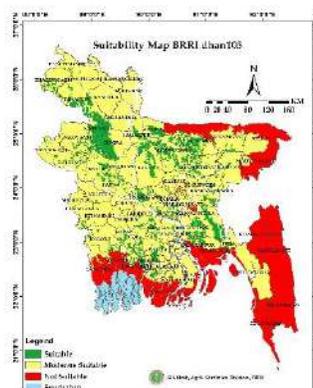
Aus Season: In Aus season, BRRI dhan106 is appropriate for north-east part of Bangladesh. Map 4 shows the suitability map of BRRI dhan106.



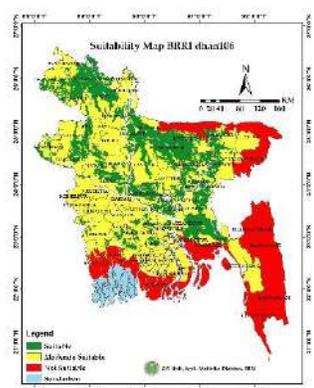
Map 1: Suitability map of BRRI dhan103



Map 2: Suitability map of BRRI dhan104



Map 3: Suitability map of BRRI dhan105



Map 4: Suitability map of BRRI dhan106

Conclusion

BRRI dhan103 is appropriate for north-west and some part of central southern area. But BRRI dhan104 variety mainly suitable in all over of Bangladesh, in addition BRRI dhan105 is suitable in north-east part. On the other hand, BRRI dhan106 is appropriate for north-east part of Bangladesh.

Activity 4.2: Climate Mapping of Temperature and Rainfall of Bangladesh

- Md. Abdullah Aziz, Md. Asadullah, Md. Ismail Hossain Niaz Md. Farhat Rahman, Md. Abdul Qayum and Md. Abdullah Al Mamun.

Introduction

Bangladesh is an agro-based country. Agriculture of Bangladesh still depends on mercy on climate. Climatic factors such as temperature, rainfall, atmospheric carbon dioxide and solar radiation etc. are closely linked with agriculture production. Therefore, rice production would be major concern in recent years due to changing climatic conditions. Because there is a significant amount of rice yield may hamper for only fluctuations of those climatic parameters (Basak, 2010). Thus, climatic factors mapping would be great tool for climatic factors analysis and assist to increase crop production.

Objectives

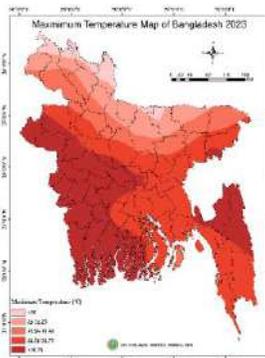
1. To determine expected maximum and minimum temperature and rainfall in different region for rice in Bangladesh
2. To determine areas of critical maximum and minimum temperature and rainfall map of Bangladesh for rice during the period and

Methodology

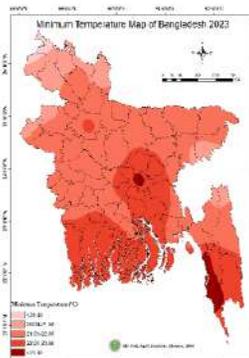
Data on daily maximum and minimum temperature and rainfall of 35 weather stations of BMD for the year of 2023 was used for the study. Year and stations wise maximum value of maximum temperature and minimum value of minimum temperature and total rainfall were determined. Then by using Geo-statistical tools of Arc GIS10.8 software maps were prepared. From the maps scenario of climatic factors were described.

Results and Discussion

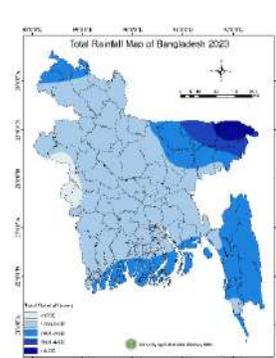
In 2023, maximum temperature was high in central western part of Bangladesh and lower in north-eastern regions. Map 5 shows the maximum temperature map of Bangladesh for 2023. Minimum temperature was lower in north-western and high was in south-east and south-west region. Map 6 shows the minimum temperature map of Bangladesh for 2023. Total rainfall was the highest in north-east corner and south-east, lowest were central and western parts of Bangladesh. Map 7 shows the total rainfall map of Bangladesh for 2023.



Map 5: Max.temp. of Bangladesh in 2023



Map 6: Min.temp. of Bangladesh in 2023



Map 7: Total rainfall of Bangladesh in 2023

Conclusion

More or less throughout the year eastern side of Bangladesh is high rainfall and low temperature area and western side is low rainfall and high temperature area. Spatial distribution of minimum temperature and total rainfall are more or less same.

Activity 4.3: Season wise rice area mapping of Bangladesh

(In collaboration with Agri. Economics, FMPHT and all R/S)

-Md. A. Aziz, Md. Ismail Hossain, Niaz Md. Farhat Rahman, Md. A. Qayum and Md. A. Al Mamun.

Introduction

Bangladesh is an agro-based country and rice is the main agricultural product. Rice contributes more than 80 percent to the total food supply (Bhuiyan et al, 2002). Now a days, remote sensing and GIS are considering as powerful tools for crop mapping, monitoring and yield forecasting. These tools are very much reliable, moreover, it is time, labor and cost effective. Identification of crop types and mapping are the first steps of satellite remote sensing-based crop monitoring and yield forecasting system (Shewalka et al., 2014). So far in Bangladesh limited research has been done for satellite remote sensing-based rice crop identification and mapping. Thus, in Bangladesh context rice mapping using Satellite remote sensing is very important.

Objectives

1. To construct season wise rice area map of Bangladesh.
2. To estimate season wise rice area of Bangladesh

Methodology

Remote sensing and GIS are considering as powerful tools for crop mapping. Satellite image was collected from MODIS data portal of NASA. Time series level 03 product image of Normalized Difference of Vegetation Index (NDVI), Effective Vegetation Index (EVI) and Land Surface Water Index (LSWI) were collected according to the respective rice growing season. Then an appropriate algorithm was developed by literature review and ground truth data. A field survey was carried out for rice area estimate of those command area by personal interview of farmers, data were also collected from DAE, BBS etc. All sources' data, including data from prepared map, were compared then best source of data will be find out.

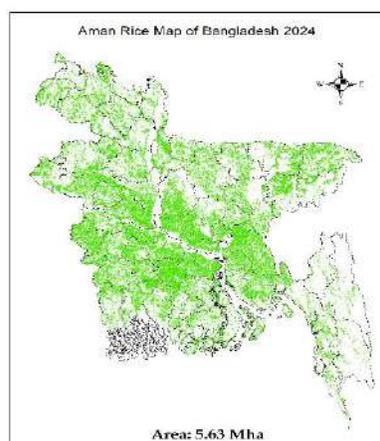
Results and Discussion:

Aman area 2024

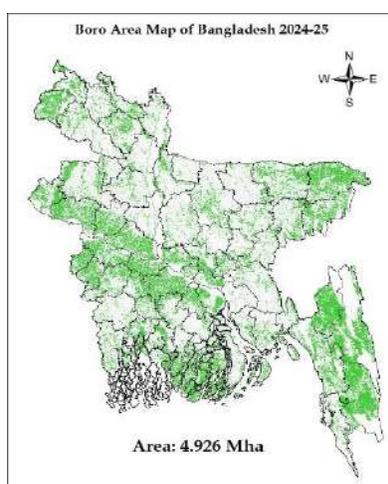
The total area of rice grown in Aman in 2024 was about 5.63 Mha. The districts with the highest of land under cultivation were Naogaon whereas the districts with the lowest of land under cultivation were Munshiganj and Narayangaj respectively. In 2023 total Aman area was 5.91 Mha. Thus, total Aman area has been decreased a little bit in the year 2024 because of sudden flood in cumilla region. In Map 8 shows the total rice area in Aman season in Bangladesh.

Boro area 2024-25

In 2024-25 total Boro area was about 4.93 Mha in Bangladesh. Naogaon district produced the highest Boro production in 2024-25. whereas the districts with the lowest of land under cultivation were Rangamati and Bandarban respectively. The total area of rice grown in Boro in 2023-24 was about 4.90 Mha.



Map 8. Aman 2024 cultivated area map



Map 9: Boro 2024-25 Area Map of Bangladesh

Conclusion

About 5.63 Mha of rice were farmed overall in 2024 during Aman season and highest Aman production district was Naogaon. In 2023 total Aman area was 5.91 Mha. Thus, total Aman area has been decreased a little bit in the year 2024 because of sudden flood in cumilla region. In 2023-24 total Boro area was about 4.90 Mha in Bangladesh. In 2024-25 total Boro area was about 4.93 Mha. Thus, total Boro area has been increased a little bit in the year 2024-25.

Activity 4.4: Projected Climatic Factors (2050) Maps of Bangladesh

- Md. Abdullah Aziz, Niaz Md. Farhat Rahman, Md. Ismail Hossain,
Md. Abdul Qayum and Md. Abdullah Al Mamun.

Introduction

Bangladesh is still significantly reliant on agriculture, and agriculture has a significant relation with climate. Bangladesh's food production is threatened by climate change. Predicting future climate changes is extremely crucial for smart agricultural planning and adapting to climate change. As the climate is changing, we need to predict future climatic conditions to cope with climate change and keep the food security of Bangladesh. This is the goal of the government of Bangladesh as well as set in the sustainable development goals (SDGs) by the United Nations to ensure food security by establishing climate resilient crop production (Rahman et al., 2021). The future prediction of precipitation would help to take necessary policies for the development of future climate resilient agricultural technologies.

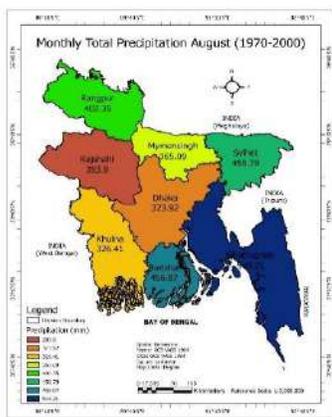
Objectives

1. Projected climatic factors maps of Bangladesh.

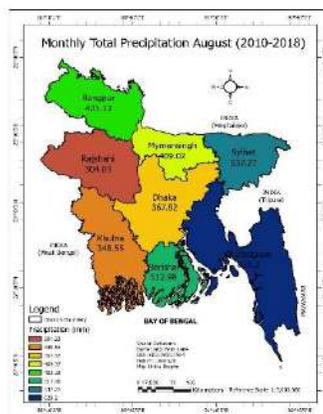
Methodology

We have collected the images of projected climatic factors results from different GCMs of CMIP5 and CMIP6 and downscale the images. To assemble and analyse climate data and generate climatic factors maps, we were used GIS techniques such as raster statistics, raster extraction, and zonal statistics.

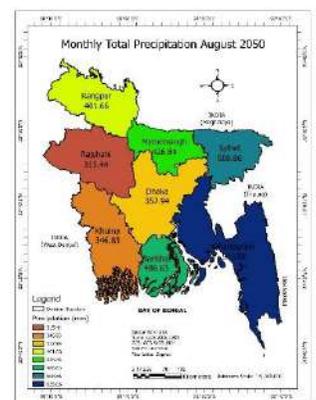
Results and Discussion:



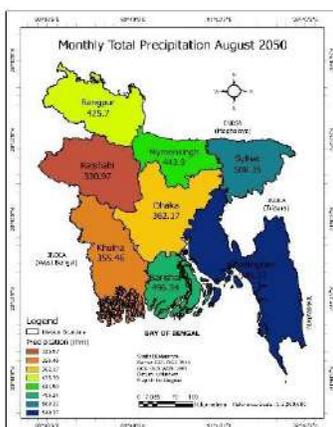
Map 10: August month average of total precipitation from 1970-2000



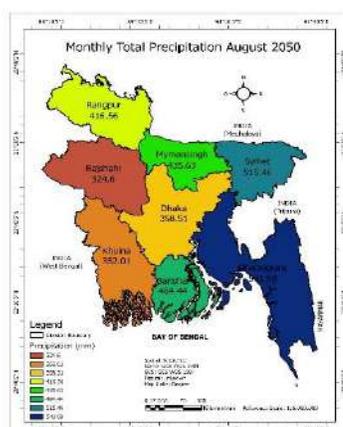
Map 11: August month average of total precipitation from 2010-2018



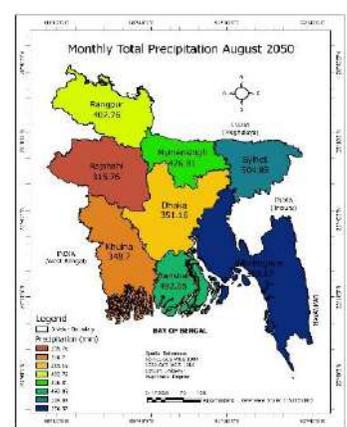
Map 12: August month average of total precipitation for the year 2050 according to RCP 2.6



Map 13: August month average of total precipitation for the year 2050 according to RCP 4.5



Map 14: August month average of total precipitation for the year 2050 according to RCP 6.0



Map 15: July month average of total precipitation for the year 2050 according to RCP 8.5

Map 10: North-east and south part of the country was under moderate precipitation and rest of the country was under lower precipitation. A division-wise analyses shows that in August month average total precipitation was highest in Chattogram division (540.21 mm) and lowest precipitated division was Rajshahi where average precipitation was 283.8 mm (Table 7).

Map11: describing division wise average total precipitation of August month during 2010-2018 where the Chattogram division was the highest precipitation (629.2 mm) and Rajshahi was the lowest (304.03 mm) precipitated division.

Map12: The division wise analyses shows that average precipitation in August month will be the highest in Chattogram division (555.06 mm) and Rajshahi will be the lowest precipitated division with an average of 315.44 mm

Map13: shows that the highest precipitation will be experienced in Chattogram division (549.37 mm) and the lowest precipitation division will be Rajshahi (330.97 mm).

Map14: representing that the highest precipitation division will be Chattogram (541.89 mm) and the lowest precipitation division will be Rajshahi (324.6 mm).

Map 15: The forecasted precipitation results are not differing much with the RCP 2.6, 4.5, and 6.0 models. The highest precipitation division will be again Chattogram (566.57 mm) and the lowest precipitation division will be Rajshahi as 315.76 mm

Table 7: Summary of August month average total precipitation of 1970 to 2000, 2010 to 2018 and forecasted 2050 (By RCP model 2.6, 4.5, 6.0 and 8.5)

| Division | Average Precipitation (mm)1970 to 2000 | Average Precipitation (mm) 2010 to 2018 | Precipitation(mm)2050 (RCP 2.6) | Precipitation(mm)2050 (RCP 4.5) | Precipitation (mm) 2050(RCP 6.0) | Precipitation (mm) 2050(RCP 8.5) | Average of Precipitation (mm) 2050(RCP 2.6, 4.5, 6.0 and 8.5) | Average of Precipitation (mm) 2050 to 2010-2018 |
|------------|--|---|---------------------------------|---------------------------------|----------------------------------|----------------------------------|---|---|
| Barishal | 456.87 | 512.98 | 486.63 | 496.34 | 484.44 | 492.05 | 489.86 | -23.12 |
| Chattogram | 540.21 | 629.2 | 555.06 | 549.37 | 541.89 | 556.57 | 550.72 | -78.48 |
| Dhaka | 323.92 | 367.82 | 352.94 | 362.17 | 358.51 | 351.16 | 356.19 | -11.63 |
| Khulna | 326.41 | 348.55 | 346.83 | 355.46 | 352.01 | 348.7 | 350.75 | 2.20 |
| Mymensingh | 365.09 | 409.02 | 426.84 | 443.9 | 435.63 | 426.81 | 433.30 | 24.28 |
| Rajshahi | 283.8 | 304.03 | 315.44 | 330.97 | 324.6 | 315.76 | 321.69 | 17.66 |
| Rangpur | 402.35 | 421.13 | 401.66 | 425.7 | 416.56 | 402.76 | 411.67 | -9.46 |
| Sylhet | 456.79 | 537.27 | 508.86 | 508.35 | 515.46 | 504.89 | 509.39 | -27.88 |

Conclusion

Average total precipitation (average by RCP 2.6, 4.5, 6.0, and 8.5 models) of Bangladesh of August month in 2050 will be decreased in comparison to average total precipitation of 2010-2018 period, only exceptions are Khulna, Rajshahi, Mymensingh divisions.

Activity 5.5: Suitability Mapping of Various Cropping Pattern

-Md. Abdullah Aziz, Md. Ismail Hossain, Md. Abdul Qayum and Md. Abdullah Al Mamun.

Introduction:

Cropping pattern is important in agricultural system. Various physical and chemical properties of soil vary spatially, on the other hand various cropping pattern are suitable for some specific physical condition. As we need to high production with limited land, so it is be very helpful if we have cropping pattern wise suitability map based on soil properties. Thus, Production will be increased if we cultivate the specific cropping pattern in their specific suitable area. Besides, suitability maps are very much useful for technology dissemination and adaptation.

Objectives

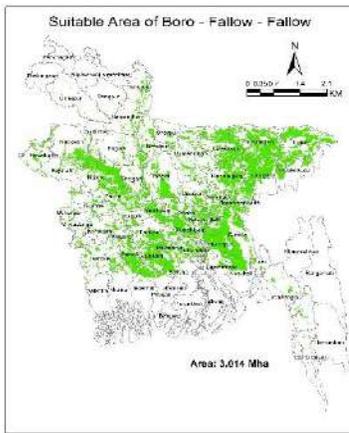
To construct suitability map of various cropping pattern.

Methodology

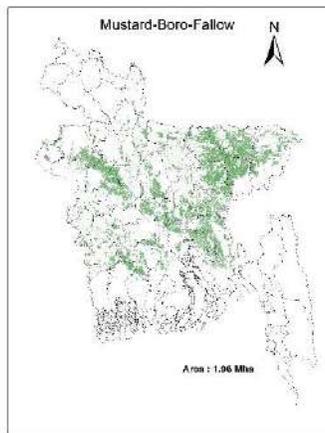
Soil physical properties and climatic parameter maps (shape file) was considered to determine suitable growing area for particular cropping pattern. Arc GIS software was used to prepare suitability maps. The suitability scale category 1 to 3 was assigned to each soil and climate characteristic in relation to particular cropping pattern cultivation by the recommendation of relevant expert. Suitable areas from different soil and climatic properties will be intersected. Finally, the suitability map was generated.

Results and Discussion

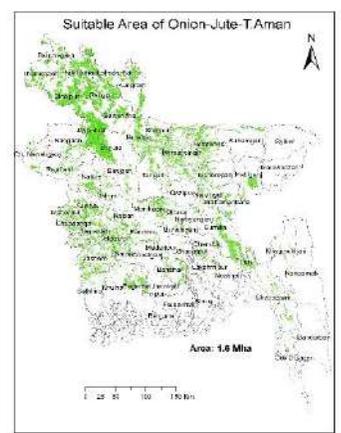
Boro-Fallow-Fallow cropping pattern is suitable in north-east part of Bangladesh (Map 16) and total suitable area is 3.01 Mha. Mustard-Boro-Fallow cropping pattern covers an area of 1.96 Mha and is suitable in north-east side of Bangladesh (Map 17). Onion-Jute-T.Aman is suitable in north-west side of Bangladesh (Map 18) and total suitable area is 1.60 Mha.



Map 16: Suitability Map of Boro-Fallow-Fallow



Map 17: Suitability Map of Mustard-Boro-Fallow



Map 18: Suitability Map of Onion-Jute-T.Aman

Conclusion

Boro-Fallow-Fallow cropping pattern is suitable in north-east part and total suitable area is 3.01 Mha. Mustard-Boro-Fallow cropping pattern covers an area of 1.96 Mha and is suitable in north-east side of Bangladesh. Onion-Jute-T.Aman is suitable in north-west side of Bangladesh and total suitable area is 1.60 Mha.

Activity 4.6: Rice yield forecasting using satellite image and machine learning in Habiganj district

-Md. Abdullah Aziz, Md. Ismail Hossain, Md. Abdul Qayum and Md. Abdullah Al Mamun.

Introduction

Traditional, direct measurements of crop yield is time consuming, laborious and costly and before harvesting it is never possible. Using remote sensing and machine learning to estimate the crop yield is less expensive and time-consuming than traditional methods, and it is ideal yield forecast with the least amount of effort. Hence the objectives of this study are to forecasting rice yields using satellite image and machine learning methods that takes less time, labour, and cost. Satellite images give timely and spatially comprehensive information on crop health and vegetation indices which have a significant impact on rice yields.

Objectives

To develop machine learning models for rice yields forecasting using satellite image that takes less time, labour, and cost.

Methodology

GIS information and yield data were collected about 15 places of Habiganj district in Boro season in 2024. Then collected NDVI collected from sentinel-2 satellite image and processed the image to collect necessary information. Here, we collected NDVI values and it helped us for yield forecasting. GIS information and yield data were collected about 15 places of Habiganj district in Boro season in 2024. Then collected NDVI collected from sentinel-2 satellite image and processed the image to collect necessary information. Here, we collected NDVI values and it helped us for yield forecasting. We used python from Google Colab to run machine learning algorithm. 80% data used as training sample and rest of data used for model validation. Finally, Validated the model. Among the linear regression (LR), random forest (RF), Support vector regressor (SVR), and ensemble model (EM).

Results

Among the linear regression (LR), random forest (RF), Support vector regressor (SVR), and ensemble model (EM) mean square error (MSE) are 0.662, 3.9206, 6.3783 and 1.8489 respectively (Table 8). Thus, we have chosen linear regression model for yield prediction.

Table 8: ML model Performance

| Algorithm Name | Mean Square Error |
|----------------|-------------------|
| LR | 0.6620 |
| RF | 3.9206 |
| SVR | 6.3783 |
| EM | 1.8489 |

Conclusion

Among the random-forest, support Vector, linear-regression and ensemble model, found that the linear regression model is the best fitted model for yield prediction but still model is not good fitted model due to lack of sufficient GPS data. So, the study should continue to improve the model.

Activity 4.7: Delineation of Rice Area changes in Costal Area of Bangladesh Using Remote Sensing Data and Machine Learning Approach

(In collaboration research with BRRI R/S Gopalganj)

- Md. Abdullah Aziz, Md. Ismail Hossain, Md. Abdul Qayum and Md. Abdullah Al Mamun.

Introduction

Rice Area of Bangladesh is not same over time. Various environmental and socio-economic causes the rice area varies over time. Moreover, recently governments have many interventions to increase the rice area, especially in coastal region like. Thus, it is important to know the effect of their program through delineate the rice area changes over time.

Objectives

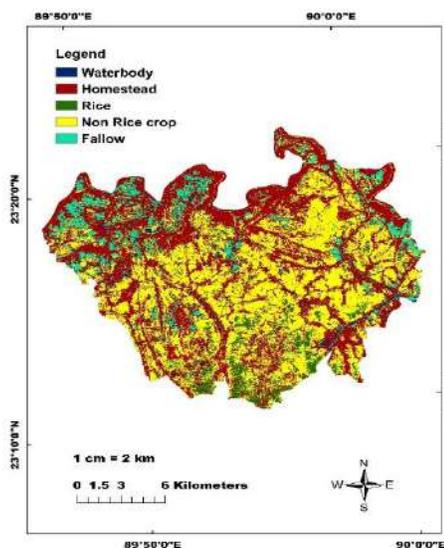
1. Delineate the rice area changes over time
2. To quantify the types of land cover that migrated into and out of the rice-growing region.

Methodology

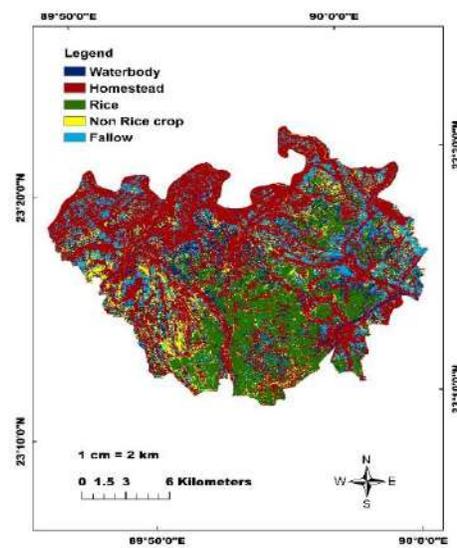
A land use land cover map (LULC) of Muksudpur upazila of Gopalganj district for Boro season of 2018 will be produced by using Sentinel-2 satellite data and machine learning technique, where, various features will be identified like, rice, others crop, fallow, waterbody, settlement area and so on. Similarly, a land use land cover (LULC) map of Boro season of 2024 will be produced. Then, matrix of LULC of 2018 and 2024 will be produced, from this matrix table, delineation of rice area changes over 2018 to 2024 will be carried out.

Results

From land use land cover map of 2018 and 2024 (Map 19 & 20) the land cover changes can be detected precisely. The Rice area has increased sufficiently in 2024.



Map 19: Land Use Land Cover of Muksudpur Upazila 2018



Map 20: Land Use Land Cover of Muksudpur Upazila 2024

From land use land cover map of 2018 and 2024 (Map 19 and 20) the land cover changes can be detected precisely. The rice area has increased sufficiently in 2024 as compare to 2018 in Maksudpur Upazila. The biggest change was in the area of non-rice crops, which decreased by 78.46 percent. The second biggest change was in the area of rice, which increased by 37.17 percent. This is likely due to many factors, including the increasing demand for food, the expansion of irrigation systems, and the development of new agricultural technologies.

Conclusion

In five years, Muksudpur Upazila's rice production areas have seen several notable changes that have revealed the dynamic nature of the area's agricultural practices and land use. Although the continuous rice farming stayed steady, there was a notable increase in the more recent rice cultivation zones, which were mostly homesteads, urban areas, non-rice crops, and fallow areas. This impressive expansion indicates that despite socioeconomic and environmental constraints, rice farming has become more popular in the area.

Project 5: Capacity Building through Training

Activity 5.1: Training Program on Experimental Data Analysis

(In collaboration with Training Division)

- Md. Ismail Hossain, Md. Abdullah Al Mamun, Md. Abdullah Aziz, Md. Abdul Qayum Niaz Md. Farhat Rahman, Md. Sahadat Hossain and Shanaj Parveen

Introduction

Training is an important and only the method for developing skills on research. To set up the experiment, collecting, compiling, reporting, analyzing and presenting of data training helps to increase the accuracy of the finding.

Objectives

1. To train up BRRRI personnel on experimental data analysis using different statistical software.
2. To make BRRRI personnel self-dependent on experimental data analysis.
3. To developed skills on research planning, program and report writing.

Methodology

Enhanced lectures and discussion, group discussion, review and feedback were the training method. Different statistical software was used for experimental data analysis. The course of schedule by two parts one for advanced MS Excel data management and analysis including data entry, coding and naming; Basic operations: Use of functional keys Date function ‘Text function’, ‘‘IF ELSE’’ function Lookup function (‘VLOOKUP’ and ‘HLOOKUP’; Data validation); Conditional formatting; Pivot table in MS Excel for 2 days. Another very interactive session for advance statistical analysis and data management using Programming R (R Studio) was also shared in this training program for 4 days. The application of different packages of R included those sessions like introduction and basic of R and R Studio; Programming R Data frame; Indexing from a vector set; Indexing of data frame; Logical Operators; Arithmetic operators and experimental data analysis including CRD, RCBD single and multiple factors, Split plot design, multiple comparisons of the test (LSD, DMRT, HSD) etc.

Results and discussion

Training program on experimental data analysis has been conducted with the collaboration of Training Division for 5 batches including 16 participants for each batch. A total of approximately 80 BRRRI scientists were trained about advanced experimental data analysis. The participants of this training were SO and SSO of BRRRI HQ and regional stations.

Conclusion

All the participants enabled to handle experimental data and analysis the data accurately by using R programming. Also, increased their capacity on experimental data analysis and data interpretation. Besides, developed their capacity on research planning, program and report writing. So, Skills of BRRRI personal on experimental data analysis have been enriched.

Activity 5.2: Training Program on Multivariate Data Analysis

(In collaboration with Training Division)

- Md. Ismail Hossain, Md. Abdullah Al Mamun, Md. Abdullah Aziz, Md. Abdul Qayum Niaz Md. Farhat Rahman, Md. Sahadat Hossain and Shanaj Parveen

Introduction

Multivariate data analysis is a type of statistical analysis that involves more than two dependent variables, resulting in a single outcome. This training gives us the clear and straightforward guideline to conduct experimental design for MVA and data analysis. Also helps us to increase the accuracy of the finding.

Objectives

1. To train up BRRRI scientists on multivariate data analysis using different statistical software.
2. To give clear and straightforward guideline of how to conduct experimental design for MVA.
3. To make BRRRI scientists self-dependent on multivariate data analysis.
4. To developed skills on research planning, program and report writing.

Methodology

Enhanced lectures and discussion, group discussion, review and feedback were the training method. Different statistical software was used for the multivariate data analysis. Dot plot, Bar plot, Graphical view of Heat map, Graphical view of the Correlation matrix and correlation plot, GGE

Biplot Analysis, Principal component analysis; Cluster analysis, multi-location trial analysis was discussed, path analysis, Genetic variability and divergence analysis were the topics of this training program. Also used some widely used R packages such as “ggplot2”, “metan” “cluster”, “factoextra”, “FactoMineR” “doebioresearch” “readxl”, “readr” etc were used to perform advanced multivariate data analysis PCA, cluster, CVA, D² and path analysis etc.

Results and discussion

With the collaboration of Training Division, the training program on multivariate data analysis has been conducted for 5 batches including 16 participants for each batch. A total of approximately 80 BRRI scientists were trained about advanced multivariate data analysis. The participants of this training were SO and SSO of BRRI HQ and regional stations.

Conclusion

The participants enabled to handle experimental design for MVA and analysis the multivariate data independently by using R programming. Then, developed their capacity on multivariate data analysis and data interpretation. Also, developed their capacity on research planning, program and report writing. So, knowledge and skills of BRRI scientists on multivariate data analysis have been enriched.

Project 6: Computer Programming, Software Development and Digitization

Activity 6.1: Develop an online integrated platform for collecting rice mapping data

- Md. Abdul Qayum, Md. Ismail Hossain, Md. Abdullah Aziz, Md. Abdullah Al Mamun and Md. Asadullah

Introduction

Information is power and the main source for decision making to the policy makers. Sustainable policy is highly depended on the accuracy of information. It is very hard to accumulate the real time information on rice land and stage live information. 4IR technologies can help to obtain the better information from big data. For collecting land position data, GPS machine is commonly used. But to collect field observation with position data for rice mapping in online, we need to develop an integrated platform.

Objective

1. To developed an online platform for collecting rice mapping data integrating Kobo toolbox server and ODK Mobile apps

Methodology and Progress

An integrated system using Kobo toolbox server (free), ODK mobile app (free but need smart mobile), Questionnaire programming and the system integration were developed with the help of a related company. The flowchart of the integrated platform is shown in the following flowchart (Fig. 6).

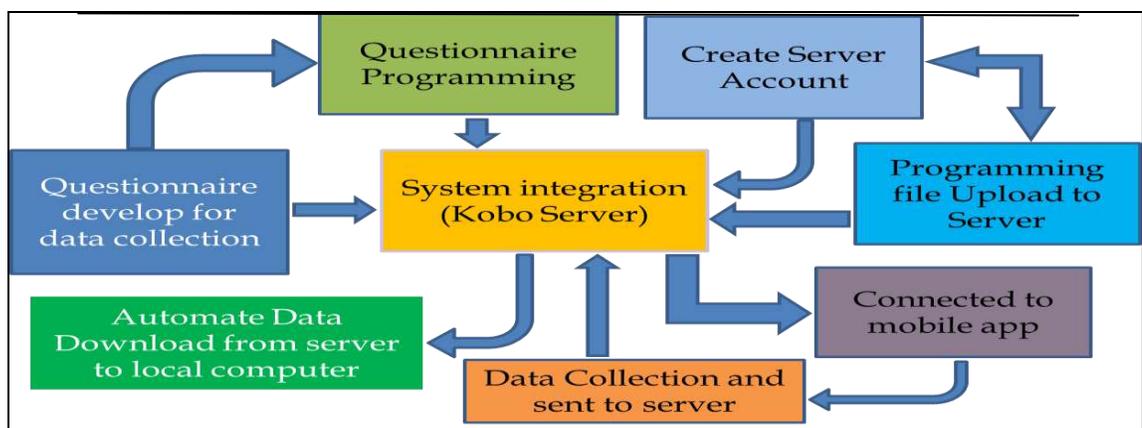
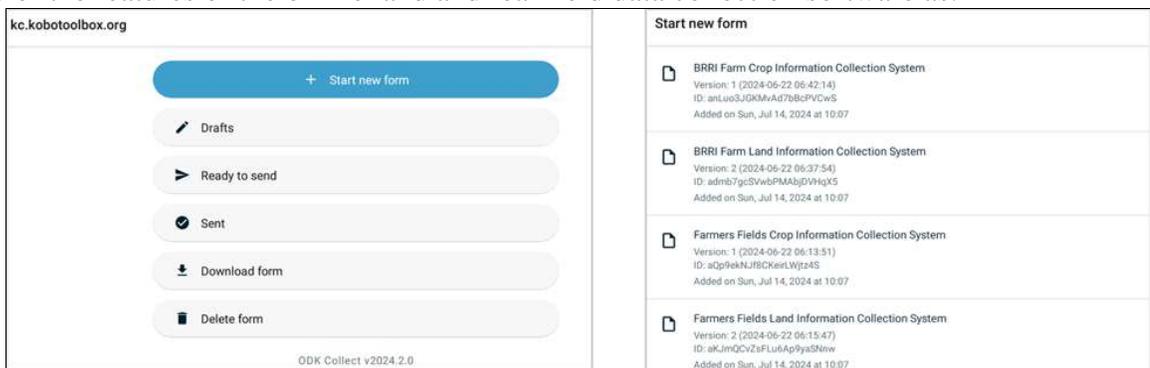


Fig. 6: Flowchart of the integrated system

Some of the features of the online land and real field data collection software as:



To collect the land and crop real field monitoring data, we update the online land and crop data collection platform in kobo server. We already collect the 44 selected land data from the four (BRRi HQ, RS Rajshahi, RS Satkhira and RS Rangpur) selected site (Fig. 7).

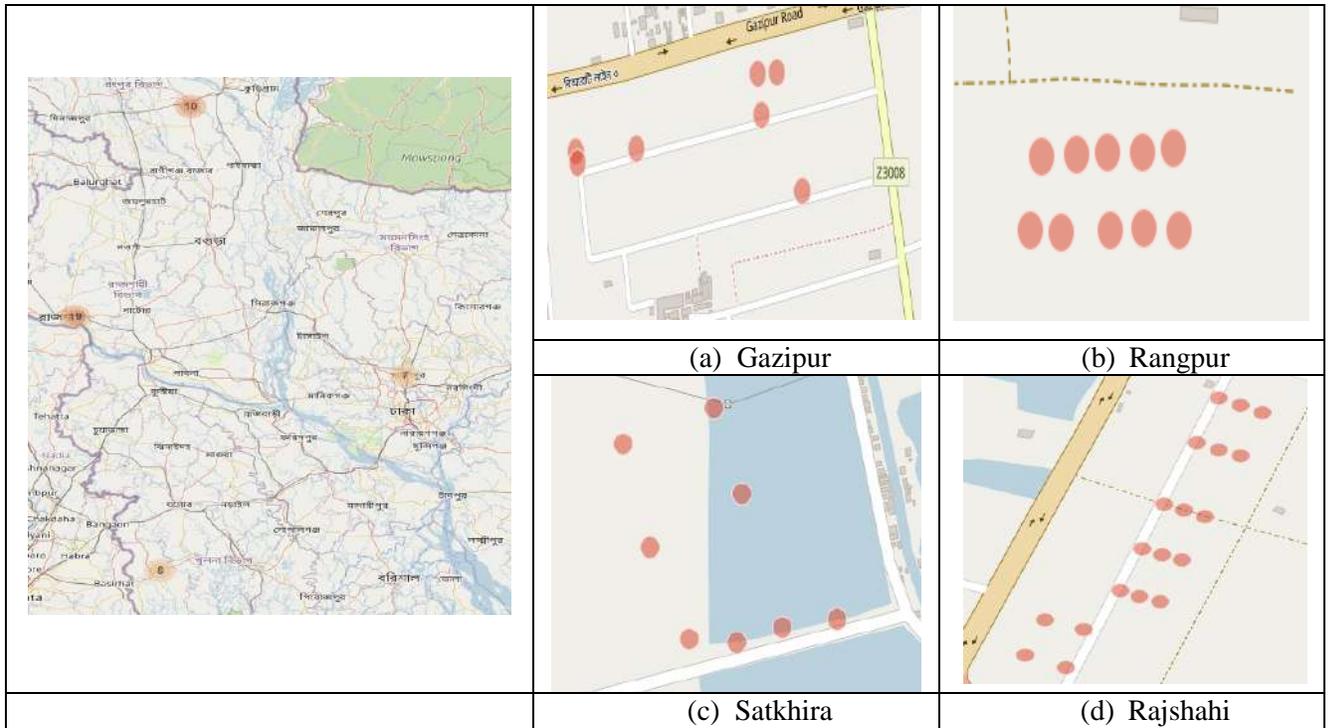


Fig. 7.: Land Position data from Kobo server

Conclusion

According to the satellite passing date all the plot’s real field condition data were collected from the four (BRRi HQ, RS Rajshahi, RS Satkhira and RS Rangpur) selected site using the developed integrated online data collection platform.

Activity 6.2: Digitalized Tour Bill Management System for BRRi HQ

- Md. Abdul Qayum, Md. Ismail Hossain, S. M. Mostafizur Rahman and Md. Asadullah

Introduction

All the service needs to digitalize to make the public service more user friendly and service in door step. Until to date the tour bill were prepared using manual system in hard paper. But this system was quite time, cost, visit and labour consuming. So that the tour bill management system needs to make digitalized. Under this activity, developed a web application for tour bill management system for BRRi HQ.

Objective

- To develop a digital tour bill management system for BRRi HQ

Methodology and Software Development Progress

Developed a database and web application System using XAMPP, HTML, PHP and JavaScript but not hosted yet. That will be easier to access, accurate, consistent and most flexible tour bill management system with the usual manual system. The login and home page of the system shown in the following figure 8.

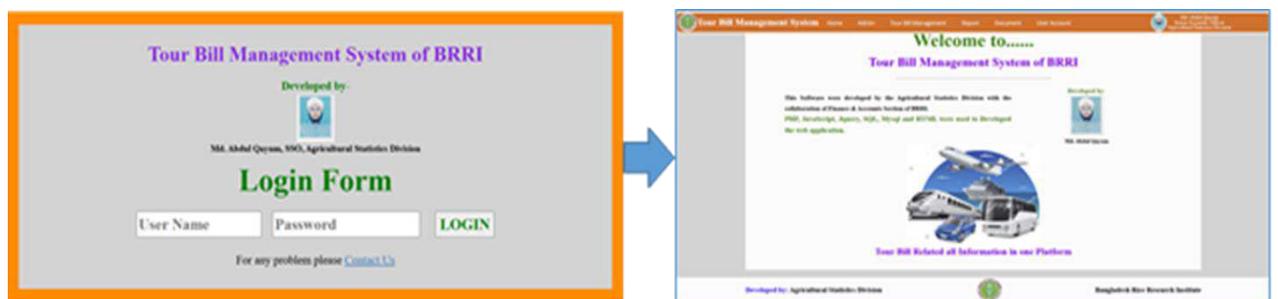


Fig. 8: Pictorial view of Tour Bill Management System Software

Conclusion

Database and web application System using XAMPP, HTML, PHP and Java Script already been developed. BRRi authority can take necessary action to complete the remaining work of the software and run the software. After developing the software, users need to be trained to use this system.

Activity 6.3: Digitalized labour management system of BRRI

- Md. Abdul Qayum, Md. Ismail Hossain and S. M. Mostafizur Rahman

Introduction

Farm Management Division of BRRI works for labour management. The division collect labour attendance data and prepared labour wages according to that collected attendance. The personnel of the division work hard for entry, updates, monitoring and reporting of the attendance as well as preparing the wages report manually. So that, many of these existing practices and procedures take many times to prepare wages report related many sheets per month. In this circumstance, Agricultural Statistics Division developed an update version (LMSV2) of the digitalized labour management system (LMS) for BRRI HQ under this program.

Objectives

1. To update “Labour Management System (LMS)” of BRRI as user need.
2. Update “digitalized Attendance system of BRRI Labour” as user need.
3. Update “Digitalized and Automated Labour Wages System” as user need.
4. Update “Digital Labour Data Centre”
5. Modify the Web Application as user need.

Methodology

The web application developed using XAMPP, HTML, PHP, JavaScript (JS) and JQuery. In this digital system all the division/section/cell entry, update and approve the labour attendance. After approved the labour attendance by the head of the division/section/cell, the software system automatically prepared the attendance report and all the report related to labour wages (Top Sheet, Overtime Summary Sheet, Deduction Report, Final Bill Report, Bank Sheet Report, etc.) in printable format after entry the electricity-gas bill by Building & Construction Division and other deduction by Finance and Accounts Section.

Progress

- Web Application software already been developed and hosted in a server (BRRI LAN)
- The application is already running.
- An update version of labour management system (lmsV2) was developed



| Dashboard for Labour Management System of BRRI | | |
|---|---------------|------------------------------|
| (From: 2023-07-01, 12:00:00am To: 2025-09-03, 02:27:20pm) | | |
| Work Item | Number | Related Information Preserve |
| Total Labours are in the Software | 491 | 8838 |
| Total Users of the Software | 160 | 2400 |
| Total Used (Hit) of the Software | 15857 | 126856 |
| Total Attendance Entried in the Software | 333469 | 3668159 |
| Total Deduction Entried in the Software | 13853 | 201264 |
| Total Information Preserve | 363830 | 4007517 |

Fig. 9: Pictorial view of the New LMS (lmsV2) of BRRI HQ

Conclusion

For digitalized labour management system of BRRI Web Application software already been developed and hosted in a server (BRRI LAN). A total of 160 users were used 15857 times of the software and 333469 attendances were entries about 491 labours. Also, total information 4007517 were preserved in the database.

Project 7: Information and Communication Technology (ICT)

Activity 7.1: Develop real time dashboard-based monitoring system for location-specific insect and disease using artificial intelligence (AI) and Machine Learning Method (MLM).

(in collaboration with Plant Pathology and Entomology div. of BRRI)

-Md. Mahfuz Bin Wahab, Md. Ismail Hossain, S. M. Mostafizur Rahman, Md. Azam Uddin, Dr. Bodrunnesa & Jannatul Yeasmin Joaty.

Objectives

1. To develop real time dashboard-based monitoring system for location-specific insect and disease using AI and MLM;
2. To determine disease and insect identifying locations through collecting necessary images and reports;
3. To manage, maintain and host web-based application at cloud server.

Introduction

BRRI has already developed a sensor-based rice pest management mobile application named “ধান সুরক্ষা (Rice Solution)” mobile app with the aim of identifying diseases easily. It is a platform where a user uploads an image or information related to any insect and disease on the app, it automatically diagnoses the matter and provide specific management advice based on the accuracy rate. As a result, the problems that arise in the field can be solved immediately and it saves time and money at the farmer level. Now based on the image analysis data of mobile apps, AI and ML based real time dashboard monitoring system has developed for insect and disease considering several locations of Bangladesh. Therefore, an electronic tool developed to explore for a smart decision support system for accessing variety information.

Methodology

The system based on approved Software Requirement Specification (SRS) and System Designing Documents (SDD). The web application developed using artificial intelligence, machine learning and sensor-based technology, which are essential technologies of the fourth industrial revolution. It is following the standard code convention, code level documentations, header of each file, algorithms, interfaces, code compression. Image sensors used through ‘Rice Solution’ mobile app for timely capturing accurate, precise and high-resolution images of insect and disease of rice from different locations of the country. Then captured image or dataset will be trained or supervised through AI. When any insect and disease is detected, this real time data sent to the cloud server for further processing through an artificial neural network (ANN).

Progress

1. Developed a real time dashboard management system as an automated decision support tool which is useful to all stakeholder i.e. policy maker, researcher, extension personnel and farmer. (Fig. 10)
2. Provided diversified information through this dashboard with identifying affected insect and disease including real time location specific detail map;
3. Manage and maintain smart web-based application.

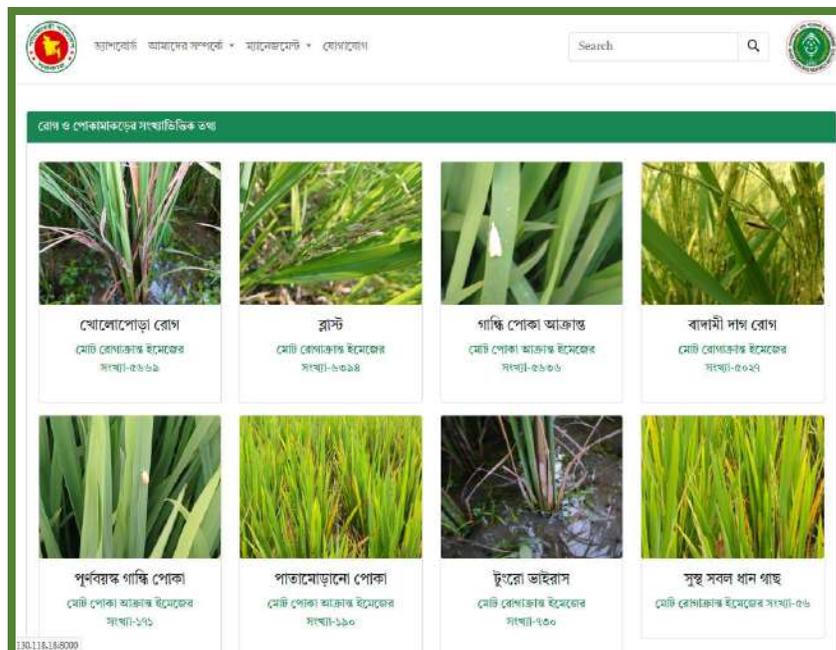


Fig. 10: Real time Dashboard

Activity 7.2: Develop an artificial intelligence (AI) based interactive e-Agriculture software & databank for research data.

-S. M. Mostafizur Rahman, Md. Ismail Hossain, Md. Mahfuz Bin Wahab, Mrs. Kabita, Md. Asadullah, Nuraiya Kulsom, Md. Aminuzzaman, Md. Akhter Hossain

Introduction

Bangladesh is embracing Artificial intelligence (AI) for the digitalization of the nation. AI is the simulation of human intelligence processes by machines, especially computer systems. The high-yielding varieties and agronomic good practice play a vital role through modern technologies like IoT (internet of things), machine learning method (MLM), artificial intelligence (AI), block chain and big data which can create a dynamic shift towards modernizing agriculture. The rice and rice related monitoring system will be developed through AI application. In database management and information architecture, a databank is a repository of information about one or more subjects. A databank may also refer to an organization primarily concerned with the construction and maintenance of such a database. A databank can be either centralized or decentralized, although most usage of this term refers to centralized storage and retrieval of information, similar to a monetary bank.

Objectives

1. To develop AI based interactive e-Agriculture software for research data of BRRI.
2. To develop AI based dashboard monitoring system.
3. To develop a big data databank using 4IR technology.
4. To manage and maintain the e-Agriculture software, dashboard monitoring system and databank.

Materials and Methods

Develop an AI based interactive e-Agriculture software & databank using python, PHP, JavaScript, jQuery CSS, HTML and data will be managed by oracle server or SQL server. That will be easier to access, accurate, consistent and most flexible system. AI based interactive e-Agriculture software & databank will be managed and maintained by ICT Cell, Agricultural Statistics Division with the help of software Developer Company.

Progress

- A proposal has been submitted to the LSTD project.
- Databank planning and design are completed, e.g. the overall management of data resources in a databank, including databank planning, databank analysis, databank design & implementation, databank maintenance, data protection, and ensuring data performance.

Activity 7.3: Smart profiling of rice varieties in Bangladesh

(in collaboration with Plant Breeding, Hybrid Rice, Biotechnology, Agronomy, Plant Physiology, Plant Pathology, Entomology, GQN and rice farming system div. of BRRI)

-Md. Mahfuz Bin Wahab, Md. Ismail Hossain, Moin Us Salam, Khondoker Mokaddem Hossain S. M. Mostafizur Rahman, Md. Abdullah Aziz, Mrs. Kabita, Nuraiya Kulsom

Objectives

1. To explore mechanism for profiling rice varieties with respect to environmental suitability, physical and physiological characteristics, yield potential and tolerance to abiotic and biotic stresses;
2. To electronically present and disseminate the newly developed smart profiled varieties information through a dynamic web application and mobile app to stakeholders;
3. To manage, maintain and host mobile and web app at server.

Introduction

The yield of rice is predominantly driven by variety. High yielding varieties (HYVs) ensure increased yield for the farmers. The BRRI, predominantly, and the BINA, partly, together with few private companies have been playing the gigantic role for releasing suitable rice varieties for the farmers of Bangladesh. The number of such varieties currently stands over 108. These varieties should be used in specific environments to ensure their yield potentials. Besides, the varieties have various life cycle (duration between sowing and harvesting) to fit into desired cropping system especially in adverse environments, such as the disaster-prone zones. Furthermore, some varieties may be good in yield, but prone to pest and diseases. In fact, the choice of a variety to sow has a

significant impact on the sustainability and profitability of rice. Therefore, farmers require comparison between the varieties to choose the right one for their specific circumstances. Currently, information on the rice varieties is available from BRRI and BINA in the form of booklets and/or leaflets. With a hard copy, it is very difficult for the farmers to compare one variety with the other. Besides, the ability to quickly update such information on newly-released varieties has been limited. Therefore, a mechanism needs to be explored for smart delivery-access of variety information. Many activities are ongoing based on technology such as digital agriculture platform generating base data for crop field condition, crop stage mapping using satellite image processing and vertical agriculture for prediction mapping (National Strategy for AI Bangladesh 2019-2024). So BRRI has taken initiative to develop a mobile app named ‘Rice Profile’ for smart profiling of rice varieties in disaster-prone zones of Bangladesh.

Methodology

Information of 108 BRRI released varieties were collected from published and unpublished literature, and through personal contact with the relevant scientists of the institute. The information included potential yield, physical characteristics, disease tolerance, insect-pest tolerance and abiotic stress tolerance. The varieties were grouped under 17 rice types (Hisham et al., 2020): (i) Favourable Boro (short duration), (ii) Favourable Boro (Long duration), (iii) Saline Boro, (iv) Cold tolerant (Haor); (v) Cold tolerant (Northern and Western regions); (vi) Healthier rice (Boro); (vii) Favourable Aman; (viii) Saline Aman; (ix) Flash flood; (x) Drought; (xi) Tidal submergence; (xii) Deepwater; (xiii) Healthier rice (Aman); (xiv) Upland rice; (xv) T. Aus; (xvi) Healthier rice (Aus); (xvii) Premium quality rice. The information will consolidate in MS-Excel spreadsheet. The system is based on approved Software Requirement Specification (SRS) and System Designing Documents (SDD). At the development stage, it will follow the standard code convention, code level documentations, header of each file, algorithms, interfaces, code compression. Application Programming Interface (API) is made sharable to with another platform.



Fig. 11: ‘Rice Profile’ mobile app

Progress

- Already included 08 (Eight) rice type out of 17 rice type information in mobile app with varietal information through this profiler (Fig. 11).
- An easy comparison system of the rice varieties has been developed for a specific environment and quickly picking up the preferred one(s).

Activity 7.4: Sensor-based rice pest management through Artificial Intelligence (AI) technology of BRRI.

(In collaboration with Plant Pathology, Plant Physiology, Soil Science and Agronomy div. of BRRI)

-Md. Mahfuz Bin Wahab, Md. Ismail Hossain, S. M. Mostafizur Rahman, Mrs. Kabita, Nuraiya Kulsom

Objectives

1. To develop AI based mobile and web App for BRRI.
2. To identify AI scopes in rice research engaging scientists, extension worker and farmers.
3. To manage, maintain and host AI based mobile and web app at server.

Introduction

Bangladesh is embracing Artificial intelligence (AI) for the digitalization of the nation. AI is the simulation of human intelligence processes by machines, especially computer systems. The high-yielding varieties and agronomic good practice play a vital role through modern technologies like IoT (internet of things), machine learning method (MLM), artificial intelligence (AI) and big data which can create a dynamic shift towards modernizing agriculture. The crop and soil monitoring system will be developed through AI application. Particular applications of AI include expert systems, speech recognition & machine vision. This app got ‘Smart Bangladesh Award-2023’ under ICT Division as Govt.-technical-Group category.

Rational/Justification

According to work plan 8.4.3 activity of National ICT Policy-2018 has stated that it will develop a single and complete agricultural input and cropping plan with integrated advisory service through IoT, Sensor, AI, Big Data analytics and real-time data feeding system. Many activities are ongoing based on technology such as digital agriculture platform generating base data for AI, IoT for crop field condition, crop stage mapping using satellite image processing and vertical agriculture for prediction mapping (National Strategy for AI Bangladesh 2019-2024). So BRRI has taken initiative to develop a sensor-based rice pest management through artificial intelligence (AI) technology.

Methodology

BRRI Rice doctor mobile and web application already developed where BRRI released rice varieties, modern rice cultivation, insect & pest, disease and agricultural machinery technologies information has included. But it is an interactive tool for farmers, extension workers, scientists/researches, teachers, students and other users when the hi-tech will be initiated. It introduced hi-tech solution through Artificial Intelligence (AI) for controlling disease & insect by image analysis. The dynamic mobile and web application automatically provide the required problem-solving solution of rice disease and pest related with proper management within one to one and a half minutes. So, image data has collected from at least three districts of different region (Gazipur sadar, Rajshahi and Cumilla) for accurate result.

Progress

- It’s automatically providing the necessary solutions to rice disease and pest related problem with proper management within one to one and a half minutes through AI and image analysis technology.
- Already it has stored and trained approximately 70000 images of several disease and insect through AI and MLM technology (Fig. 12).



Fig. 12: Sensor-based rice pest management mobile app

Activity 7.5: New version of rice knowledge bank (RKB) mobile Apps

-S. M. Mostafizur Rahman, Md. Ismail Hossain, Md. Mahfuz Bin Wahab, Mrs. Kabita, Md. Asadullah, Nuraiya Kulsom, Md. Aminuzzaman, Md. Akhter Hossain

Introduction

A mobile application called mobile app is a type of application designed to run on a mobile device, which can be a smartphone or tablet computer. Even if apps are usually small software units with limited function, they still manage to provide users with quality services and experiences.

Objectives

1. To develop the new version of RKB mobile apps.
2. To develop a push notification system.
3. To manage and maintain RKB Mobile apps.

Methodology

The mobile application of Rice Knowledge Bank (RKB) is a type of application software designed to run on a mobile device, such as a smartphone or tablet computer. RKB is a dynamic mobile application and also mobile base knowledge bank. It has been developed with the information of BRRI released rice varieties, modern rice cultivation and agricultural machinery technologies, insect and disease management, soil and fertilizer management, irrigation and water management, quality rice seed production management, training and publications. It is an interactive tool for farmers, extension workers, scientists/researchers, teachers, students and other users who want to learn and control insects & diseases and other problems that can occur in rice, and how to manage them.

Progress

- Google supported architecture of rice knowledge bank (RKB) mobile apps has been completed (Fig. 13).
- Data have been collected from different Regions (Rangpur Region in 2024 season, Kushtia Region in 2024 season and Barishal Region in 2025 season) of Bangladesh.
- Data entry and processing have been going on.
- Training on data collection has been continued.



Architecture of rice knowledge bank (RKB) mobile

Fig. 13: New version of rice knowledge bank (RKB) mobile Apps

Activity 7.6: Develop a new website for BRRI

-S. M. Mostafizur Rahman, Md. Ismail Hossain, Md. Mahfuz Bin Wahab, Mrs. Kabita, Md. Asadullah, Nuraiya Kulsom, Md. Aminuzzaman, Md. Akhter Hossain

Introduction

A website is a collection of web pages and related content that is identified by a common domain name and published on at least one web server such as google.com, yahoo.com, facebook.com and amazon.com. All publicly accessible websites collectively constitute the World Wide Web (www). There are also private websites that can only be accessed on a private network, such as an internal website for its users. Websites are typically dedicated to a particular topic or purpose, such as news, education, commerce, entertainment, or social networking. Hyperlinking between web pages guides the navigation of the site, which often starts with a home page. Users can access websites on a range of devices, including desktops, laptops, tablets, and smartphones. The software application used on these devices is called a web browser. Some websites require user registration or subscription to access the content. For examples of subscription websites include many business sites, news websites, academic journal websites, gaming websites, file-sharing websites, message boards, web-based email, social networking websites, websites providing real-time data, as well as sites providing various other services.

Objectives

1. To develop a new website for national and international seminars and symposiums.
2. To manage domain or sub-domain for the new website.
3. To host the new website at server.
4. To manage and maintain the new website.

Methodology

A new website was developed by the ICT cell, Agricultural statistics division. The website is an interactive platform for scientists, researchers, DAE personnel, teachers, students and others who want to get information and also submit their papers, abstracts and posters for attaining the international and national seminars & symposiums. The software is visible by using <https://gsfy.brri.gov.bd> URL.

Progress

Bangladesh Rice Research Institute arranges national and international seminars and symposiums. Having a website makes it very easy for people to find information and also submit their papers, abstracts and posters for attaining national and international seminars and symposiums. Read up about BRRI, discover what BRRI does, and answer a bunch of questions they have. By having a website people will be able to get information about BRRI when they search on a search engine like Google, Yahoo or Bing. Developed new website named Glory and success of 50 years (<https://gsfy.brri.gov.bd>) for national and international seminars and symposiums of BRRI. The website has been used to get information and submit their papers, abstracts, posters and others (Fig. 14).

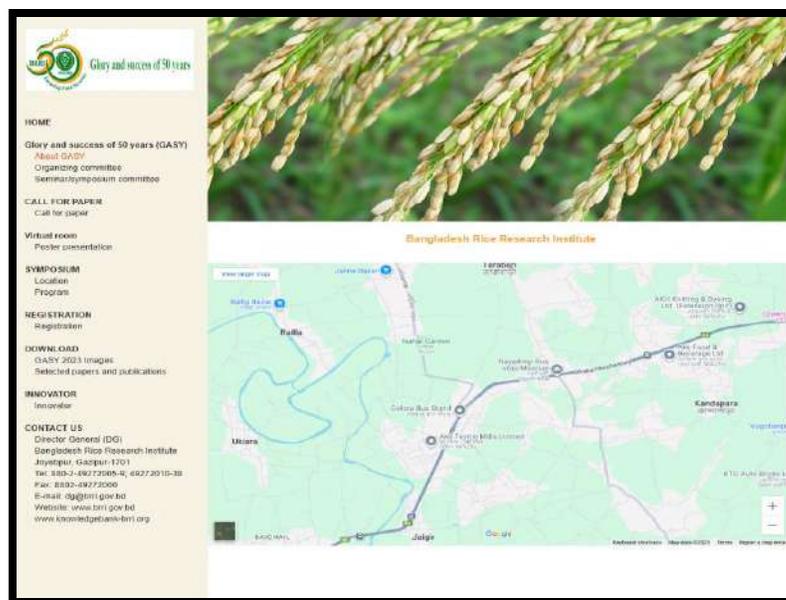


Fig. 14: New website for BRRI

Activity 7.7: Vehicle Management System of BRRI

- Md. Mahfuz Bin Wahab, Md. Ismail Hossain, S. M. Mostafizur Rahman, Kabita, Nuraiya Kulsom, Md. Aminuzzaman, Md. Akhter Hossain

Introduction

VMS is an automated scripted transportation management system (TMS). The transportation pool management activities of BRRI are complex and updating the allottee individually in time which is tedious work. The designated official of Transport division is needed to work after office to manage the official vehicle requests and to convey the confirmation to the requester and driver over the phone. VMS will ease the allotment work using a simple requisition management system that doesn't require any advanced computing skills and the confirmation will be sent using SMS and email.

Objectives

1. To develop vehicle management system (VMS) for BRRI.
2. To inform through SMS, on the basis of demand vehicle at BRRI.
3. To provide SMS for drivers for confirming their upcoming duty.
4. To host VMS at server.

Methodology

Vehicle Management System (VMS) is a transportation pool management activity of BRRI are complex and updating the allottee individually in time which is tedious work. The designated official of Transport division is needed to work after office to manage the official vehicle requests and to convey the confirmation to the requester and driver over the phone. VMS doesn't require any advanced computing skills and the confirmation sent using SMS and email. So that, the requester informed through SMS on basis of demanding vehicle for official or personal purpose as well as driver get confirmation SMS for their upcoming duty. The database has already developed and architecture design has been finalized. The information of all vehicle of BRRI (driver's name, mobile number and vehicle reg. number etc.) has been collected from transport section

Progress

- The VMS has already developed. The Application Programming Interface (API) sharing with other system is continuing.

Activity 7.8: Training on Innovation, Service Process Simplification (SPS) and D-Nothi management for enhancing capacity of BRRi employee

- Md. Mahfuz Bin Wahab, Md. Ismail Hossain, S. M. Mostafizur Rahman, Mrs. Kabita, Nuraiya Kulsom, Md. Aminuzzaman, Md. Akhter Hossain

Introduction

Innovation can be defined simply as a "new idea, device or method". Whereas Service Process Simplification (SPS) is a tool to simplify access to public services thereby reducing the time, cost and number of visits (TCV) required for citizens to access them. It is essential to introduce the culture of innovative practices that would accelerate and simplify the BRRi research activities and service delivery process. BRRi has implemented all innovation activities and conducted various training on PSI, SPS and D-Nothi management under several annual innovation work plan of BRRi.

Objectives

1. To provide various training on public service innovation (PSI), SPS and D-Nothi management to BRRi scientists and officers for developing capacity.
2. To bring qualitative changes in the internal research work process and service delivery in BRRi HQ and respective regional stations.
3. To compile various innovative idea through PSI and SPS training for piloting and replication activities.

Methodology

Innovation and Service Process Simplification (SPS) tool is essential to introduce the culture of innovative practices that would accelerate and simplify the BRRi research activities and service delivery process. Agricultural Statistics Division has implemented all innovation activities and conducted various training on Public Service innovation (PSI), Service Process Simplification (SPS), Simple implementation Project (SIP) and D-Nothi management and several annual innovation work plan of BRRi.

Progress

- Two day-long ‘Public Service Innovation’ training has completed on 24-25 April, 2024 at BRRi premises.
- Two day-long ‘Service Process Simplification (SPS)’ training has completed on 26-27 April, 2024 at BRRi premises (Fig. 15).

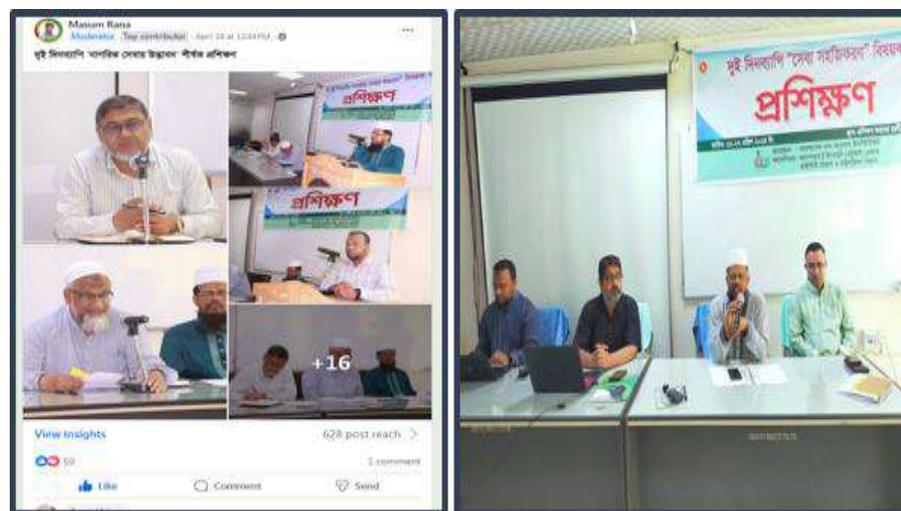


Fig. 15: Training on SPS and Public Service Innovation

Activity 7.9: BRKB Website Management of BRRi

(In collaboration with training, breeding and others research divisions)

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Introduction

Bangladesh Rice Research Institute (BRRi) developed the Bangladesh Rice Knowledge Bank (BRKB) web application. BRKB is a digital extension service that provides practical knowledge solutions, specialized for small-scale farmers in the country. BRKB is a treasure of rice knowledge. This is a dynamic source of knowledge that has been updated regularly to keep consistency with the latest innovations and users' feedback. BRKB showcases rice production techniques, agricultural technologies and best farming practices based on research findings in the country. The BRKB contains rice knowledge to address the regional as well as national issues associated with rice production and training.

Objectives

1. Provide more benefit to all users specially farmers, extension workers, researchers etc.
2. Include more information about rice production and related publications.

Methodology

BRKB Website has managed, maintained and modified by ICT Cell, Agricultural statistics division in collaboration with training, breeding and others research divisions. BRKB is updated regularly with the latest information of rice varieties, modern rice cultivation, pest management, soil and fertilizer management, irrigation and water management, quality rice seed production management, training and publications. Most of the materials i.e., fact sheets, training manuals, booklets, leaflets, brochures, posters have been prepared in Bengali, which are easily understandable to farmers and extension workers. The main sections of BRKB are rice cultivation methods, Boro rice varieties and production methods, Aman rice varieties and production methods, soil and fertilizer management, rice insects and their management, irrigation and water management, photo gallery etc (Fig: 29). “BRKB” web application has been developed by WordPress, JAVASCRIPT, HTML, CSS, InDesign, fireworks and MYSQL database.

Progress

- In this reporting year, we have developed twenty-two web and mobile-based fact sheets. And all fact sheets have been uploaded to the BRKB website (Fig. 16).
- Updated with the latest information of Aman, Aus and Boro rice varieties included the latest variety of BRRI dhan114, BRRI dhan113, BRRI dhan112 and BRRI dhan111.
- All types of information i.e., soil and fertilizer management, insects and rice diseases management etc. also updated regularly.
- A total number of 4,98,490 users have been visited the website.



Fig. 16: BRKB Website

Activity 7.10: BRRI Web Portal Management

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Introduction

The National Portal Framework (NPF) is the single platform for accessing all public information from any government organization to ensure easy accessibility for citizens. Counting all ministries, departments, semi-government and autonomous organizations and all government offices at the division, district, upazila and union levels there are about 27,000 government offices.

Objectives

1. To develop and modify the design of BRRI Web Portal.
2. To manage and maintain BRRI Web Portal through regular updating of the information and documents.

Methodology

BRRI web portal (www.brri.gov.bd) has been developed by ICT cell, Agricultural statistics division with help of Access to Information (a2i) Programme. BRRI has been incorporated with it as a first organization among the NARS institute. It is a citizen-oriented web portal so the large majority of the population including farmers, researchers, extension officers, students, and teachers are benefited from BRRI Web Portal.

Progress

- In this reporting year, updated more than 1620 (one thousand six hundred and twenty) pages and uploaded more than 7165 (seven thousand one hundred and sixty-five) documents like PDF, JPG, report, Word and other files on the BRRi website (Fig. 17).
- In the reporting year, sent twelve website reports to the ministry of agriculture (MoA).
- BRRi has made the web portal in both Bengali and English languages. It is the largest web portal (www.portal.gov.bd) in the world and BRRi is incorporated with it as the first organization among the NARS institute.
- Developed Glory and Success of 50 years, BRRi Writer's pool, Rice pest corner and many more.
- Included the rice database, climate database, Bangladesh Agriculture at a Glance etc. on BRRi dynamic website and updated it regularly.
- To make it more updated and informative, developed individual web page of headquarter, regional stations, and all satellite stations of BRRi.



Fig. 17: BRRi Web Portal

Support Services and ICT related fair

The scientists of this division are also engaged in helping scientists of other disciplines in planning experiments, statistical data analysis and interpretation of results. Sixty different types of analyses were performed during the reporting period. A number of maps were prepared using GIS and supplied to the scientists of other divisions whenever required.

Overall, ICT Cell of Agricultural Statistics division is providing D-Nothi system related support services to all research division, administration and procurement section. It is also providing BRRi heritage related support services such as updating data and uploading information to other divisions. Though it is an initiative in government perspectives but *BRRi Networks* face book group and face book page is a first introduced amongst all National Agricultural Research System (NARS) and also first among all research institute. It is regularly monitoring and updating with new information from any national and international newspaper or other sources. It is continuous process. Otherwise, ICT Cell of Agricultural Statistics division is providing hardware, network and internet related support services to other divisions such as setup antivirus software, clean virus, update antivirus database and various troubleshooting related problem etc. ICT Cell of Agricultural Statistics Division has been participated in several ICT and related fairs such as Digital World Fair, Development Fair, Tatha Mela and World Food Fair etc.