

# 2016 National Rice R&D Highlights

INFORMATION SYSTEMS  
DIVISION



Department of Agriculture

Philippine Rice Research Institute

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## Information Systems Division

*Division Head: Jovino Lopez De Dios*

### Executive Summary

Rice production data, information, technological knowledge, and innovations on processes and models are the resources at PhilRice that are accessible to the right users at the right time. These resources serve as fuel and guides to contribute in attaining the PhilRice goal, “Rice Secure Philippines”. Using the Information and Communications Technology (ICT), standard procedures, good practices, effective policies, and the information systems infrastructure herein helps empower our clients to transact regardless of their geographical location and temporal circumstances.

The Information Systems Division (ISD) projects are using the potentials of ICT in creating Agricultural Information Systems (AgIS) and Management Information Systems (MIS) to increase resource productivity. Information systems infrastructures, both software and hardware, are being developed internally or in collaboration with other agencies to pool the resources and increase efficiency. The mainstream is AgIS that assists PhilRice clients, researchers and other rice stakeholders in collecting, transmitting, storing, analyzing and sharing data and information related to rice. The MIS helps in the administrative processes, like financial management, project management, and other PhilRice resource management processes. ISD helps PhilRice internal operations and Research and Development activities by providing services and creating information systems related to rice and management processes.

### I. Gearing Towards Converging Agriculture and Information Systems (AGIS)

*Project Leader: Arturo Arocena Jr.*

The use of information technology (IT) has grown rapidly in the past decades in the Philippines. Its use in agriculture is dramatically increasing since the last few years in the fields of rice research, extension, and production. Mobile and stationary IT gadgets help the workers in getting information and instructions; the managers in better decisions; and other stakeholders in their own fields of endeavor. However, because of constant change in human needs and environmental conditions, technology and processes should be continuously updated to cope-up with more challenges to be solved in the present up to the future.

The project aims to develop a responsive, stable and timely information system and processes; integrate multiple information technologies and



systems that can assist managers and stakeholders. To help empower the agricultural industry in the capability to collect, transmit, store data; and share information using the most cost effective information systems infrastructure.

### PhilRice Soil Information System: A tool for effective crop management (ISD002-001)

WB Collado, RB Bermudez, JL de Dios

The study aims to (1) optimize the soil management subsystem in the PhilRice Database Management and Information Portal (PhilRice DBMP) for its systematic soil data collection, organization, storage and retrieval procedures; (2) analyze data and provide agricultural stakeholders with updated and accurate information on the rice soil resources; (3) provide a new soil information system model that is comprehensive, more responsive to the needs of the stakeholders and accessible to all users; (4) continue the development of soil series guidebooks for easy identification of the soil series based on sub-horizon color, texture, soil pH and other distinguishing characteristics; and, (5) improve and continuously update the new online soil management database subsystem.

#### Activities:

- Development of Simplified Keys to Soil Series field guidebook at Provincial level.
- Conduct soil series field validation and characterization.
- Laboratory Analysis of soil samples.
- Conduct seminar and orientation on the use of the Simplified Keys to Soil Series guidebook and On-line PhilRice Soil Information System.

#### Results:

- Field Guidebook Development (Simplified Keys to Soil Series) The study has completed the development of the soil series field guidebooks for the province of Abra, Bohol, and Nueva Vizcaya (Figure 1). There are (11) soil series in Abra, (13) soil series in Bohol, and (14) soil series in Nueva Vizcaya. The result of crop suitability analysis for different soil series of Abra were shown in Table 1, Bohol in Table 2, and soil limitation and recommended management for Nueva Vizcaya in Table 3.

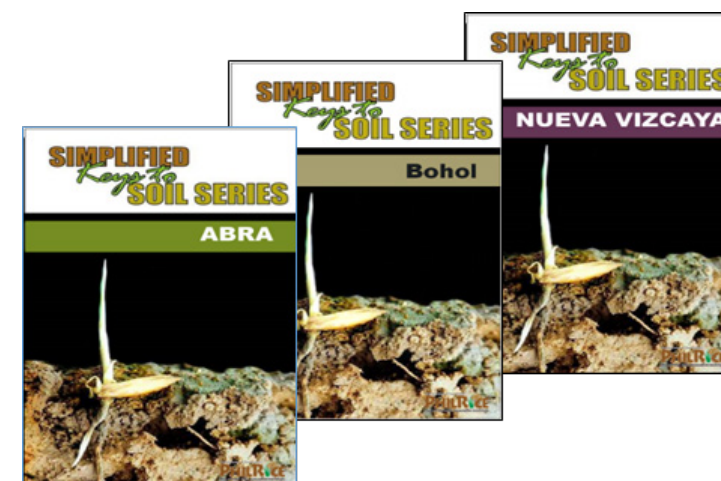
Abra contained soil series namely Alimodian, Bantay, Bauang, Bigaa, Binangonan, Bituin, Bolinao, Cervantes, Maligaya, San Manuel, and Sevilla series. These soil series were categorized into four color groups: (1) Reddish brown for Bolinao, Bituin, Cervantes, and Maligaya series; (2) Dark grayish brown for Bauang and San Manuel series; (3) Black/grayish brown for

Bigaa, Binangonan and Sevilla series; (4) Light/yellowish brown for Alimodian and Bantay series. Among 11 series, Bituin series covered the largest portion of the province approximately 41,000 hectares, followed by Bauang series ( $\approx 29,000$  ha) and Cervantes series ( $\approx 21,000$  ha) as calculated using the DA-BAR Philippine Soil Map. Soils of Abra in terms of its inherent productivity index ranges from 0.33 to 0.86 and a potential 0.55 to 0.96 for lowland rice.

**Table 1.** Crop suitability ratings of different soil series of Abra.

Philippines Top Agricultural Commodity	SOIL SERIES				
	Alimodian	Bantay	Bauang	Bigaa	Binangonan
Sugarcane	S3ctwsf	S2ctws	S2ctsf	S2cwf	S2ctws
Rice Irrigated Lowland	N2ctsf	N2cwsf	N2cwsf	S2csf	N2ctsf
Rice Rainfed Upland	S3ctwsf	S2ctwsf	S2ctsf	S2cwsf	S3ctw
Rice Rainfed Lowland	S3ctwsf	N2ctws	S3ctwsf	S2csf	N2cts
Coconut	S2ctws	S2cts	S2ctsf	N1cw	N1ctw

Philippines Top Agricultural Commodity	SOIL SERIES					
	Bituin	Bolinao	Cervantes	Maligaya	San Manuel	Sevilla
Sugarcane	S2ctwf	S2ctf	S2ctwsf	S2cwf	S2cwf	S2ctf
Rice Irrigated Lowland	N2ctwsf	N2ctsf	N2ctwsf	S2ctsf	S2cwsf	N2ctsf
Rice Rainfed Upland	S2ctwf	S2ctf	S2ctws	S2cwsf	S3cwsf	S2ctsf
Rice Rainfed Lowland	S2ctwf	S3ctwf	S3ctwsf	S2cf	S3cwsf	S2ctwsf
Coconut	S2ct	S2ct	S3cts	N1cw	S3cwf	S2ct



**Figure 1.** Soil series field guidebook of Bohol.

Results showed that majority of the soils were moderately suitable to sugarcane except Alimodian series. Series like Bigaa, Maligaya and San Manuel are moderately suitable for lowland irrigated rice. And soil series of Bigaa, Bituin, Maligaya and Sevilla are moderately suitable in both rainfed lowland and upland rice condition. Coconut trees seemed to be moderately suited for Alimodian, Bantay, Bauang, Bituin, Bolinao, and Sevilla series. In terms of root crop production: (1) Bolinao series for camote and cassava, (2) Bantay, Bigaa, Maligaya, and San Manuel series for camote and potato, (3) Bauang, Cervantes, and Sevilla series for cassava and potato are all moderately suitable.

In addition, Bituin and Bauang series found to be moderately suitable for cabbage and tomato. While Maligaya and Sevilla series are both moderately suitable for papaya, mango and banana production. Sevilla series is the only series that are both moderately suitable to corn and pineapple. Growing of onion in the soils of Abra is marginally suitable which means that several limitations has to be considered to achieve better quality and yield.

Bohol contained soil series namely Annam, Baluarte, Bantog, Batuan, Bolinao, Calape, Candijay, Faraon, Inabanga, Lugo, Mandawe, Sevilla, and Ubay series. These soil series were categorized into five color groups: (1) the black/dark brown for Candijay, Mandawe and Sevilla series; (2) grayish brown/brown for Bantog and Calape series; (3) dark brown/brown for Annam, Baluarte and Faraon series; (4) yellowish brown/brown for Inabanga and Ubay series; and (5) reddish brown/brown for Batuan, Bolinao and Lugo series. Among the 13 soil series identified, Ubay series covers the largest portion of Bohol province with a calculated area of 142,470 hectares and Mandawe series as the smallest (58 hectares) using the DA-BAR soil map. Soils of Bohol in terms of its inherent productivity index ranges from 0.36 to 0.83 and potential productivity index of 0.61 to 0.93 for rice.

Majority of the soils are moderately suitable for sugarcane and upland rice. Calape, Candijay and Mandawe series are moderately suitable for irrigated lowland rice while Baluarte, Batuan, Calape, Candijay, Inabanga, Mandawe and Sevilla series are moderately suitable to rainfed lowland rice. Baluarte, Candijay and Calape series are highly suitable for coconut. There are also soil series that are moderately suitable to vegetables, root crops and fruit trees.

**Table 2.** Crop suitability ratings of different soil series of Bohol.

Philippines Top Agricultural Commodity	SOIL SERIES						
	Annam	Baluarte	Bantog	Batuan	Bolinao	Calape	Candijay
Sugarcane	S2ctwf	S2cf	S2ctwf	S2csf	S2ctwf	S2csf	S2cf
Rice Irrigated Lowland	N2wft	S3tf	N1sft	S3sft	N2wfts	S2tsf	S2tsf
Rice Rainfed Upland	S2ctwf	S2cf	S2ctwf	S2cs	S2ctwf	S2csf	S2cf
Rice Rainfed Lowland	S3ctwsf	S2cwsf	S3ctwsf	S2cwsf	S3ctwsf	S2cwsf	S2cwsf
Coconut	S2t	S1	N1twf	S2sf	S2tw	S1	S1

Philippines Top Agricultural Commodity	SOIL SERIES					
	Faraon	Inabanga	Lugo	Mandawe	Sevilla	Ubay
Sugarcane	S2ctwsf	S2ctws	S2ctws	S2cwsf	S2ctf	S3ctwsf
Rice Irrigated Lowland	N2sft	N2twf	N2wsft	S2sft	N1sft	N2twsf
Rice Rainfed Upland	S2ctws	S2ctws	S2ctws	S2cwsf	S2ctf	S3ctwsf
Rice Rainfed Lowland	N1ctws	S2cws	S3ctws	S2cwsf	S2ctwsf	S3ctwsf
Coconut	S2twsf	S2tw	S2ts	S2wf	S2t	S2tw

**Table 3.** Sample soil limitation and recommended management of different soil series in Nueva Vizcaya.

Soil Series	Limitation for crop production	Soil Management Recommendations			
		Rice	Diversified crops	Root crops	Tree/Forest/ Plantation crops
Annam	Aluminum (Al) and Iron (Fe) Toxicity; acidic soil; run-off sloping topography causes excessive erosion; presence of large amount of gravels, pebbles, cobbles and boulders	Permanently not suitable for rice production	Marginally suitable for diversified crops; liming, contour terracing, green manuring, large initial application of phosphate fertilizers, strip cropping	Marginally suited for root crops; liming, contour terracing, application of organic matter to improve soil fertility	Suited for secondary growth forest, can be planted to coconut, papaya and mango trees
Cropping Pattern: diversified crops-rootcrops/trees					
Bago	Poor drainage; slower N mineralization; Zn deficiency in rice; K deficiency; low organic matter	Sufficient irrigation supply with adequate drainage; green manuring; K fertilization; application of ZnS2O4 in lowland rice when deficiency occurs	Can be planted to sugarcane, corn and tomato; OM incorporation; sufficient irrigation supply with adequate drainage; green manuring; fertilization	Can be planted to root crops provided with good drainage system and adequate irrigation supply; adequate fertilization; OM incorporation	Fruit trees like mango and banana; observe good drainage system
Cropping Pattern: rice-rice, rice-diversified crops/rootcrops/trees					
Bantog	Poor drainage; high shrink and swell capacity upon wetting and drying producing wide cracks in the soil, hard when dry; seasonal flooding in low areas; slow permeability	Practice shallow cultivation when soil moisture is at optimum; suited for irrigated and rainfed paddy rice; maintain properly the paddy rice; establishment of flood control system	Construction of adequate drainage, irrigation and flood control system due to seasonal flooding hazard in low areas; use of broadbeds, ridges or furrows and mulching; application of organic matter and farm manure	Establishment of adequate drainage and irrigation systems; application of organic matter and farm manure; can be planted to camote and potato	Can be planted to shallow-rooted fruit trees like banana and mango; establishment of adequate drainage and flood control system
Cropping Pattern: rice-rice, rice-diversified crops/root crops					
Brooke's	Low soil fertility; poor drainage which can cause low N mineralization and Zn deficiency	Application of zinc sulfate in lowland rice when deficiency occurs; N, P and K fertilization; construction of drainage control system	Marginally suitable to diversified crops; construction of drainage control system; fertilization	Can be planted with potato; construction of drainage control system; fertilization	Suited for banana and mango trees; construction of drainage control system; fertilization
Cropping Pattern: rice-rice, rice-diversified crops/root crops					

Nueva Vizcaya contained soil series namely Annam, Guimbalaon, Rugao, San Juan Sevilla, Sibul and Sta. Filomena as upland soils; and Bago, Bantog, Brooke's, Maligaya, Quingua, San Manuel and Umingan series as soils of the plains. Annam series is the largest contributing series of Nueva Vizcaya with an area coverage around 89,000 hectares while Sta. Filomena series is the smallest series mapped in the province. The inherent and potential productivity index of soil series for lowland rice production ranges from 0.32 to 0.88 and 0.45 to 0.95, respectively.

There are four soil series found to be moderately suitable for irrigated lowland rice cultivation (Bago, Bantog, Brooke's, Maligaya) and four series for rainfed upland/lowland rice production like Rugao, Sevilla, and Sta. Filomena including Maligaya series. Some of the remaining series were marginally suited to rice farming which requires careful evaluation in addressing soil limitations and in making decisions. Some of the soil limitations being observed pertains to poor drainage, low fertility, rolling relief and incidence of erosion and flood.

Field validation and characterization of soils were also conducted in Mindoro. Soil series that were validated are: Calupang series in Calapan, Magsaysay series in San Jose, Tagaytay series in Bulalacao, and Tilik series in Lubang. Pit for each soil series was dug for the soil profile morphological description, pictured, geo-referenced and soil samples were collected for analyses and verification that maybe Binangonan, Bituin, Baluarte, Calape, Candijay, Inabanga, Ubay, Burgos, Makar, Jasaan, Tilik, Magsaysay, Tagaytay, and Calumpang series. Laboratory analysis included pH, cation exchange capacity, available P, K, Na, Mg, Ca, organic matter and soil texture.

Fifty-five soil samples have been submitted to the Mach Union laboratory for analysis. These includes soil samples of Binangonan, Bituin, Baluarte, Calape, Candijay, Inabanga, Ubay, Burgos, Makar, Jasaan, Tilik, Magsaysay, Tagaytay, and Calumpang series. Laboratory analysis included pH, cation exchange capacity (CEC), available P, K, Na, Mg, Ca, organic matter (OM) and soil texture.

- PhilRice Online Soil Information System  
Orientation on the on-line soil information system and seminar on the use of soil series field guidebook were conducted on six (6) occasions. The initial seminar was held at PhilRice CES where the target participants were the researchers of different

divisions. The second orientation seminar was conducted at Ilocos Norte for the provincial and regional coordinators and field staff of PRISM. The third seminar was conducted within the community stakeholders and research agency. It was held at PhilMech during the IT seminar series "Gusto Naming Productive IT Users Kayo" for PhilRice and Science City of Muñoz. Three additional seminar workshops were held at PhilRice branch stations namely Batac, Midsayap, and Isabela participated by researchers of different specialization.

### **Advancing Information Systems for Research and Development (ISD002-002)**

*AC Arocena, J Germino, E Dicen III, HDC Cayaban*

The study aims to develop and deploy a resilient AgIS capable of collecting and transmitting small to large datasets using mobile devices and can directly organize and present intelligence data in multi-format such as geographic information system (GIS), tabular, and graphical which can be downloaded online using the integrated management and client consoles for faster and easier data and information sharing.

Rice statistical information is vital to the success of a project or the implementation of a rice program. This help identify the public needs to be addressed, the number of people affected, the places where they are found, and the people to be benefited. Furthermore, it points out to planners, policymakers and researchers which areas of development need special attention and which research areas need to be pursued, refined and further improved.

#### **Activities:**

- Develop and deploy application tools for field data collection and transmission.
- Integrate the application tools into an Information Systems for data organization and storage, processing, and sharing.
- Develop prototypes Information Systems that maximize the machine-to-machine data interchange and minimize human interaction.
- Develop IS for Rice and Rice-based Technology Extension Project for ARMM (JICA-TCP5 Computerization) and for the Monitoring of Rice-Based Farm Household in the Philippines.
- Finalize the development of an integrated web-based portal for the JICA-TCP5 project which interactively provide func-



tionalities for data capture and organization, monitoring, and reporting.

- Develop System Analysis and Design (SAD) for Rice Based Farming Household Survey (RBFHS) data collection application.

## Results:

- Finalized the development of an integrated web-based portal for the JICA-TCP5 project which interactively provide functionalities for data capture and organization, monitoring, and reporting:
  - Finished the web-based portal and data editing module of the JICA-TCP5 computerization (Figure 2). This module provides interactive and user-friendly interface for data editing and validation.
  - Finished uploading of formatted matrices (Figure 3). Users can import data from CSV file format to MySQL DB format.
  - Additional eForm capable for inputting, saving and exporting data for the Bangsamoro Baseline Survey Round 2016 (Figure 4).
  - Created and established SQLite Database for the added form; Upland Rice-Based Farming Technology transfer program for the Bangsamoro Baseline Survey Round 2016.
  - Enhanced Web-Analytics; Rice Technologies Adopted and Vegetable Technologies Adopted (Figure 5).
- Finalized and approved System Analysis and Design (SAD) document
  - Accomplished component diagrams like Business Process; System Process, Data Flow, Communication Flow, Use-case Diagram, Entity relationship and Database Filing System (Figures 6-9).
- Developed a prototype e-form based on the android platform for data collection of the RBFHS 1.0 (Figure 10)
  - Created Login Module for RBFHS 1.0
  - Login module can accept and validate enumerator's code through manual typing and scanning of Bar/QR code.
  - Finished eForm blocks.
  - eForm block are capable of inputting, saving and data extraction.

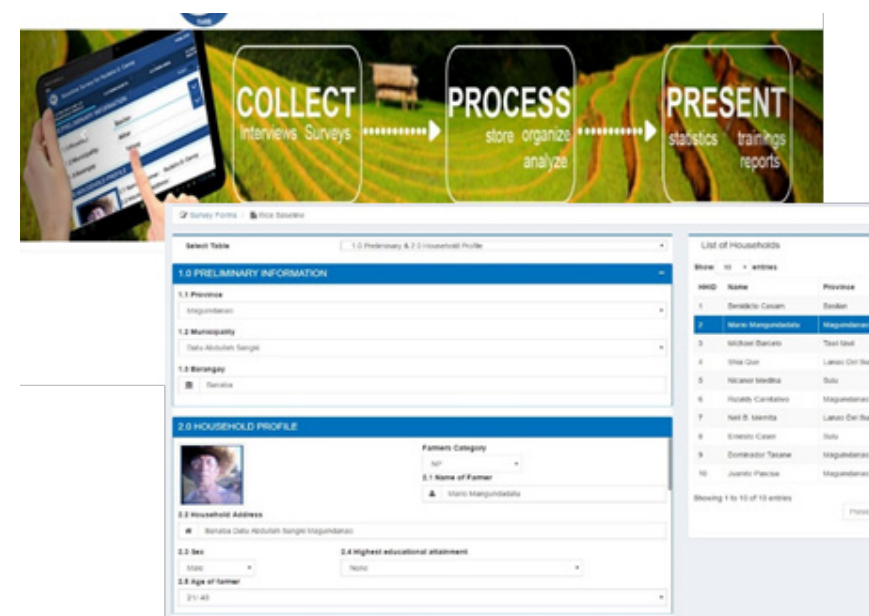


Figure 2. Web-Based Portal and Data editing.

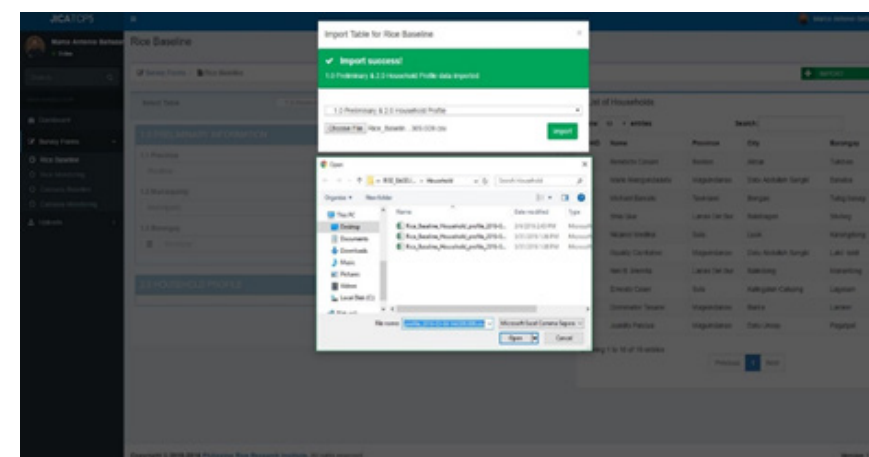


Figure 3. Web-Based Portal Data importing user interface.

The screenshot shows the JICATCP5 mobile application. The top part displays a welcome message: "Welcome to JICA TCP5. Install the Required Components?" with "Exit" and "Yes" buttons. Below this is a data entry form titled "Bangsamoro Survey for Donie Nietes". The form includes sections for "1.0 PRELIMINARY INFORMATION" (Province, Municipality, Barangay) and "2.0 HOUSEHOLD PROFILE" (Farmer's name, address, sex, education, age, ethnicity, farming experience, etc.). The bottom part of the screen shows a search bar and a profile card for "Donie Nietes" with a "SAVED" status.

Figure 4. Added form for JICATCP5 data gathering.

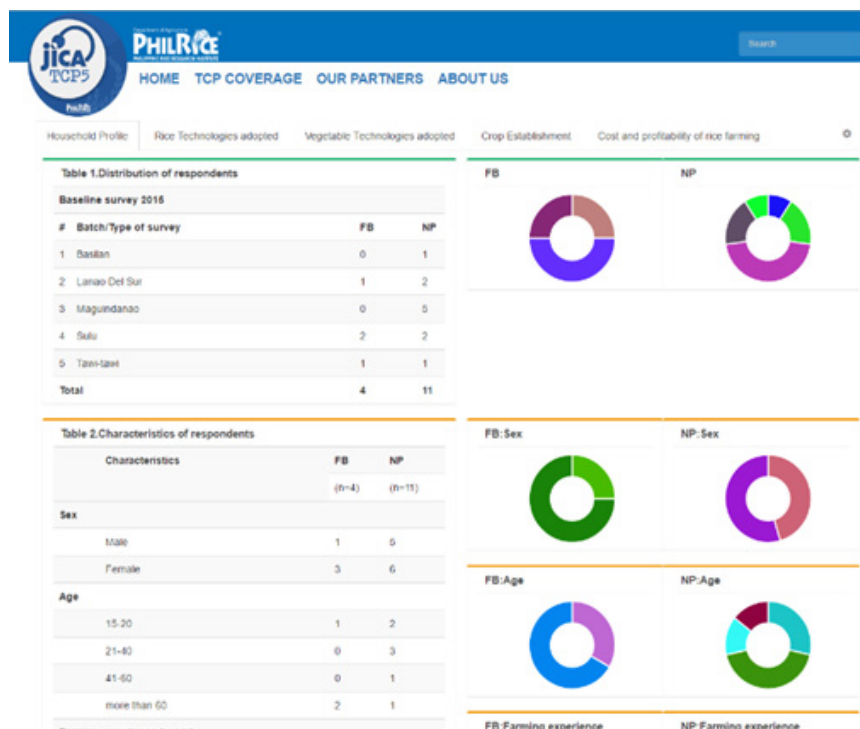


Figure 5. The Analytics Interface.

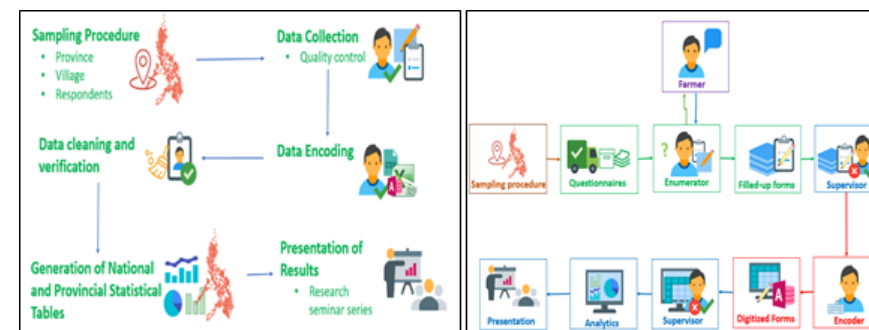


Figure 6. Business process and system process diagrams.

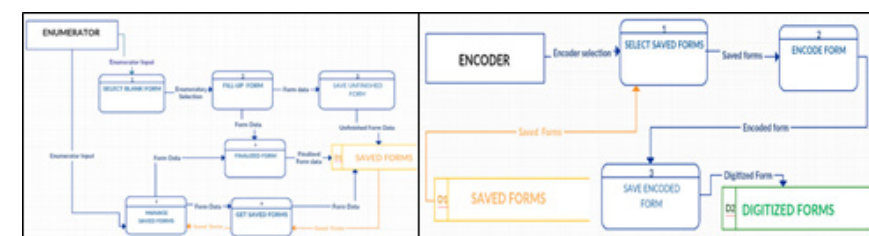


Figure 7. Data Flow Diagrams.

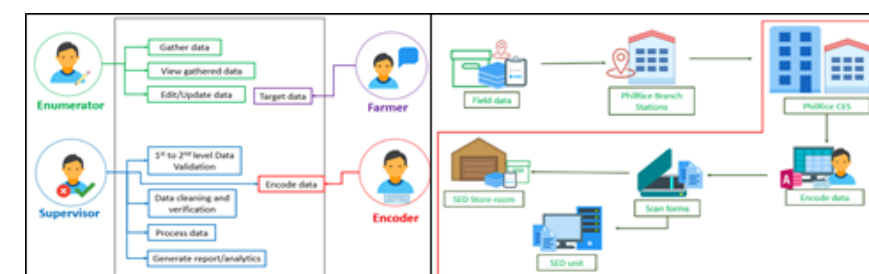


Figure 8. Use Case and database filing system diagrams.



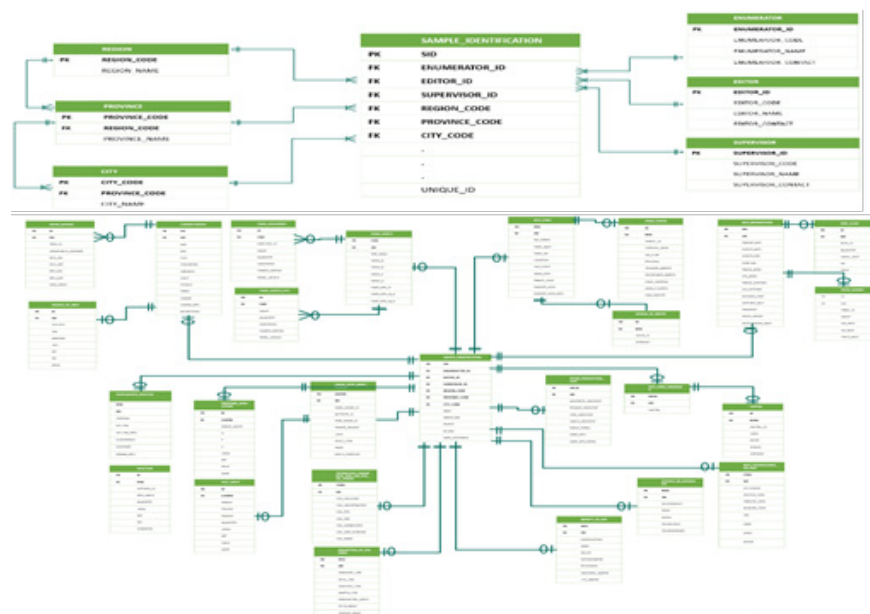


Figure 9. Entity Relationship Diagram.

Figure 10. RBFHS Adding respondent data.

## Sustaining and Extending the PhilRice Data and Information Portal (ISD002-003)

HC Cayaban, J Gamilla, J Delos Santos, AC Arocena, JL de Dios

Access to accurate and updated rice data and information is very important for all rice stakeholders. While frequent data collection and updating activities are being performed, utilization of data is still needs to be improved because volumes of data and information usually end-up in stock rooms and steel cabinets or in a computer hard disks and external drives. Besides, these types of data sources are prone to losses due to disasters and single machine failure. The lack of data warehouse results to ineffective sharing of resources, which results to repetition of work or activities, leading to unsuccessful project implementation.

The study aims to transform, maintain, expand and populate the PhilRice databases. The activities required will effectively establish, maintain off-site backup, and update existing or build-up new database management systems and platforms for research and development activities.

### Activities:

- Improve and maintain the Rice Database and Information portal to dynamically manage sub-systems within its domain.
- Enhance the sub-systems content and functionality, normalize database structure and update processes.

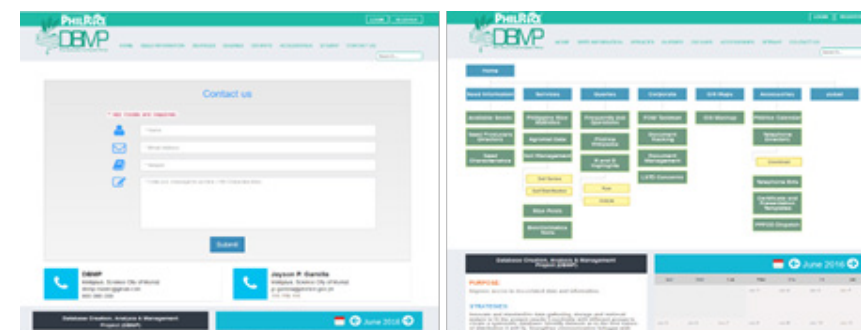
### Results:

- The Rice Database Management and Information Portal (DBMP) was improved from static to dynamic. The change is based from the active subsystems installed in it. Improved the Information portal's user management console. Created a centralized login for content management of subsystems (Figure 11). The user permissions is controlled by the portal administrator where grants to the subsystem administration is managed. The login security was improved using password encryption and session verification scheme.
- Contact us module was improved for queries about the portal. The new contact page is dynamic and the portal administrator can modify the content of the page (Figure 12).
- Improved PhilRice Soil Information System (Figure 13). The new Soil Information System was redesigned from back-end (database) to front-end (Graphical User Interface). Its database is now normalized and controllable which increased the performance of the system. The user interface is now user-friendly and easy to navigate the pages. The Soil IS has now content management system (CMS) to easily manage its contents. It has a feature that can import data using CSV files.

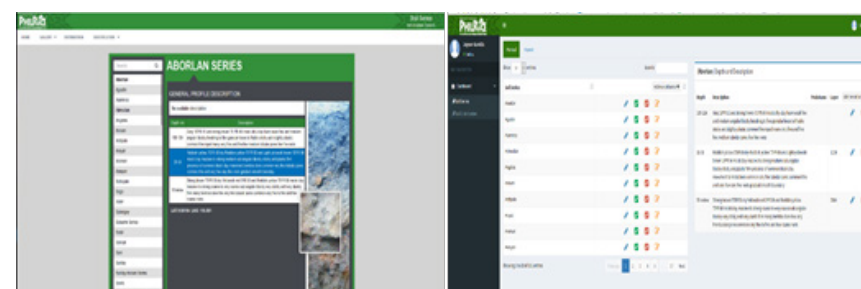
- Improved Research and Development Highlights system. (Figure 14). The database of this system is now normalized. It was improved to have a manageable content for future system data and faster system performance.
- Improved the Seed Producers Directory system (Figure 15). The system now has a working Integrated Content Management System wherein the administrator can add or update seed growers data using eform. Interactive map is improved and created an import function of seed growers data (CSV file).
- Optimized the Seed Characteristics system (Figure 16). Developed a Content Management System for data management rather than accessing directly the database. Adding and updating now works using GUI and inputting information through eForms.
- Optimized the Frequently Asked Question system (Figure 17). Developed a Content Management System to easily manage pending questions and existing posts. The adding and updating data now utilizes enhanced eForms and a feedback through email whenever there is a response is now present in the system.



**Figure 11.** Centralized login for content management system (CMS) of DBMP.



**Figure 12.** Dynamic Contact us module and Sitemap module.



**Figure 13.** Improved PhilRice Soil Information System webpage designs.



**Figure 14.** Improved R&D Highlights system.

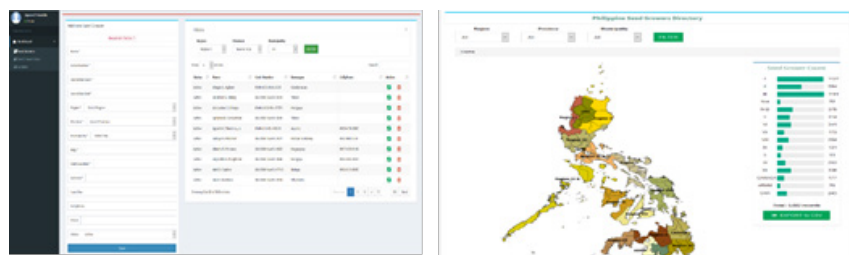


Figure 15. Improved Seed Grower Directory Information System.

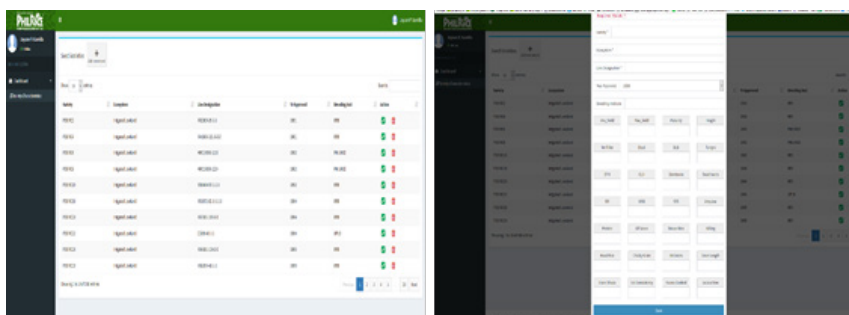


Figure 16. Content Management System of Seed Characteristics Information System.

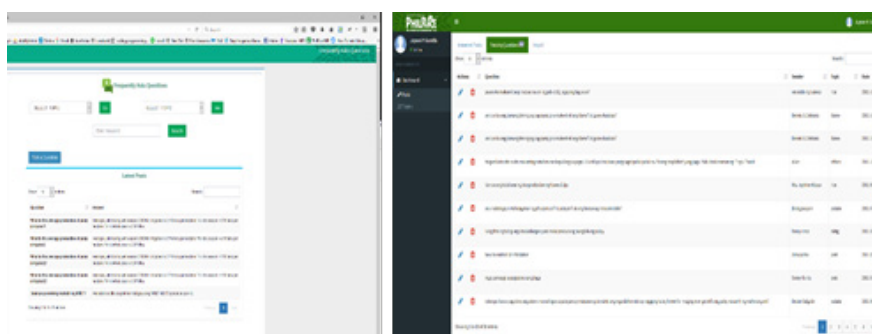


Figure 17. Improved Frequently Asks Question Information System.

## II. Corporate Information Systems Development and Sustainability (ISD003)

Project Leader: Benjamin C. Sotto/Jovino L. de Dios

The project intends to help the institute in securing its research and development assets and become a front runner among government agencies in the advocacy, adoption and utilization of ICT in its operations and in provision of public service. Also, to enhance and maintain the existing IS and develop innovative information technology solutions in support to research and development operations.

Specifically, 1) to develop and deploy practical and smart IS that helps in the project management, strategic planning, management control, operational control and transactional processing; 2) Upscale and maintain the current IS to meet the needs and standards of emerging technologies; 3) Helps in the operations that includes database backup, recovery, testing, and performance tuning; 4) Conduct capacity enhancement trainings and seminars to IT users; and 5) Establish partnership and/or network collaboration with ICT communities.

### Human Resource Information System (HRIS) Management and Sustainability

BC Sotto

The Human Resource Information System (HRIS) is a web-based information systems that features access to employee's data. It also features interoperability to support other systems in the institute, secured, accessible, and compliant to system standards and policies. The system is integrated with other developed systems. It provides updated data to the Financial Management Information System (FMIS), Daily Time Record (DTR) system, and Payroll system. Currently, it can be accessed in PhilRice CES local area network through secured login.

#### Activities:

- Manage and sustain HRIS.
- Provide customer acceptance report and testing report.
- Provide system endorsement report.
- Conduct user-training.

#### Results:

- Developed File Management module with the following functions ( Figure 11):
  - Uploading of e-files/scanned docs of employee.
  - Downloading/Printing of file.
  - Content management system that can add, edit, and delete entries.



- Developed Designations module with the following functions (Figure 12)
  - Content management system that can add, edit, and delete entries
  - Appointing of employee to the designation with reference to the effective date.
  - Uploading and downloading of scanned copy of supporting documents to the designation.
  - Viewing of summary of designations per employee.
  - Link to other modules (DTR, Leave, and Service Records) that queries designations (Division heads, OIC, ED, DEDs, etc.).
  - Prioritizing of querying between two designations (e.g., Division Head and OIC).
- Integrated two subsystems (Payroll and Leave system) to HRIS (Figure 13).
  - Leave system was ready for beta testing in June.
  - Parallel testing for Payroll system was started in May.
- The DTR module and Holidays management function were moved to HRIS from their old server address for security, integration and centralization of systems (Figure 14).
- Modified the two modules (Career Development and Reports module) as per requested by client.
- CMS of other data libraries was also added to the Admin Panel of HRIS.
- Customer Feedback Report was provided on April 19, 2016.
- Assisted in connecting ID printing software to the database of HRIS.
- Deployed HRIS in Agusan, Negros and Midsayap).branch Stations and collaborate with HRMO in orientation/ training of point person (Figure 18)

### **Project Management System (PMS) development**

*BC Sotto, MA Gacutan*

This activity is a work on progress with the Corporate Services Division (CSD) that is to develop a centralized and secured document management system for PhilRice projects. The IS features include: profiling of programs, projects, & studies; budget monitoring; task management; and statistics.

#### **Activities:**

- Provide System Analysis and Design (SAD) document.
- Develop a working prototype consists of: front-end UI, CMS (programs, projects, & studies), report generation module, and

user management module.

#### **Results:**

- Provided PMS Decomposition diagram (Figure 19).
- Specified the functions and features of the proposed system.
- Provided two (2) process flow diagrams (submission of concept proposal, adding of projects/studies)
- Programmed the GUI design.

### **PhilRice Document Tracking Systems (PDTs) development**

*JQ Palileo, MA Gacutan*

This activity includes: improvement of the PDTs in terms of database structure and design, graphical-user-interface (GUI), functionalities, data processing, and process flow; and development of new functions not existing in the old version. This activity also includes designing a connectivity solution for document tracking including branch stations.

#### **Activities:**

- Revisit and update PDTs System Analysis and Design.
- Develop PDTs version 2 that includes: object-oriented programming; admin Content Management System, new GUI design, report generation module, user management module, and integration to FMIS.

#### **Results:**

- Configured PDTs database for integration with the FMIS.
- Developed PDTs Admin module that includes: Report generation, User Management, & new GUI design.
- Developed new version of PDTs (Figure 20 & 21) for Beta testing with new interface design, Database structure, Improved existing functionalities (archiving, change of status, tracking of documents), Dashboard and notification module, Reports generation and Analysis modules (Institute Report, Performance report) and User Management module
- Developed local version for branch stations with integration functionality.

## Database Management Activity

MA Gacutan, JL de Dios

This activity includes the development and maintenance of database servers, the backup, and recovery procedures of concerned applications under the project.

### Activities:

- Full back-up and manage databases of the project.
- Maintain 99.9% web presence of corporate portals (PhilRice web, library web, VCSO and RTM page)
- Back-up 99.9% data and database.

### Results:

- Conducted regular database backup of PhilRice web, Library web, VCSO Reservation system, and RTM website.
- Performed full image backup of corporate server (www.phil-rice.gov.ph) last May 13, 2016.
- Restored the PhilRice website from hacker attack and implemented layers of security last May.
- Configured/registered eight (8) new NAS accounts and provide technical orientation.
- Managed and maintained two (2) development servers: one server for HRIS & DTR (192.168.10.111) and one server for RBSEIS, PDTS, & e-registration (192.168.10.19).

## Capacity Enhancement and Information Systems Related Activities

BC Sotto, MA Gacutan, EE Joshi

### Activities:

- Conduct training and/or seminars.
- Organize an innovative web and/or mobile application competition.
- Provide event documentation and evaluation.
- Respond to IS concerns and provide technical assistance to project-related activities.

### Results:

- Conducted five (5) IT productivity seminar series for PhilRice and Community Stakeholders (CES, PhilMech, Batac, Agusan, & Isabela). (Figure 22 & 23)
- Served as resource person for IT Productivity Seminar series.
- Conducted AgriHackathon symposium on November 15, 2016. Co-worked with FutureRice. (Figure 24)
- Led the Registration committee of two (2) institutional field days (Lakbay Palay DS & WS) 2016 in preparation, electronic

attendance, and e- raffle. (Figure 25)

- Provided Lakbay Palay DS & WS 2016 registration and attendance reports to TMSD.
- Provided PDTS monthly summary reports for performance reference of Admin Assistants (AAs), and 2015 PDTS Tracking summary to OED, ODD, and IAU as per requested.
- Configured PDTS accounts of new AAs of CES.
- Configured DBMP accounts.
- Provided technical support for BeRiceponsible Website.
- Restored PhilRice e-Store website for e-books.

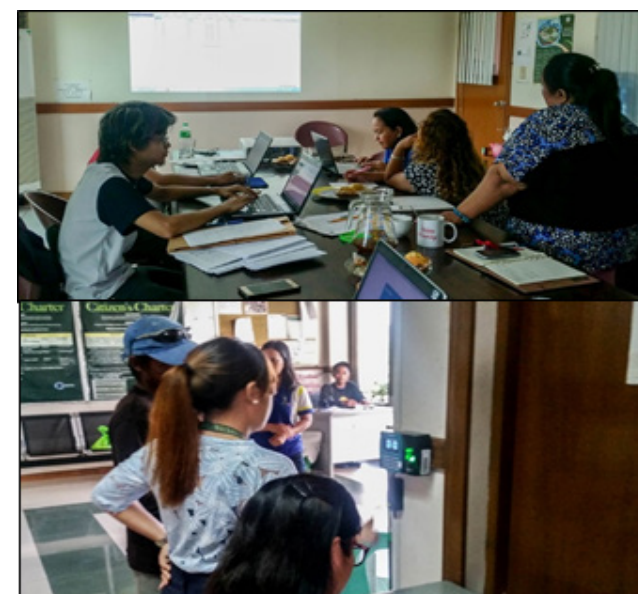
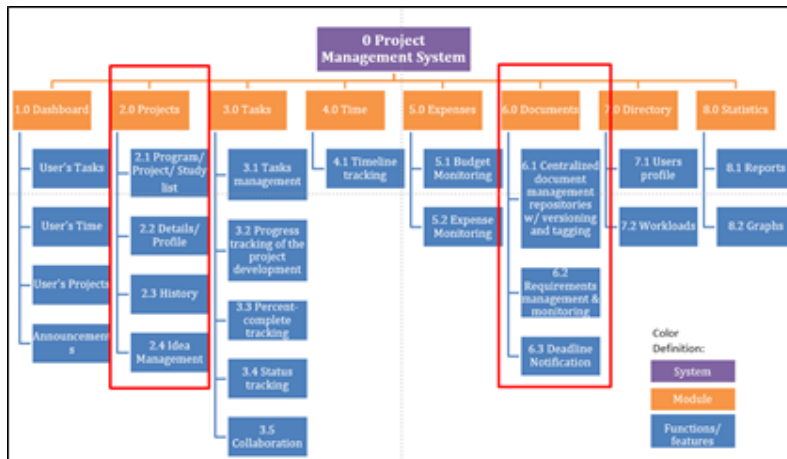
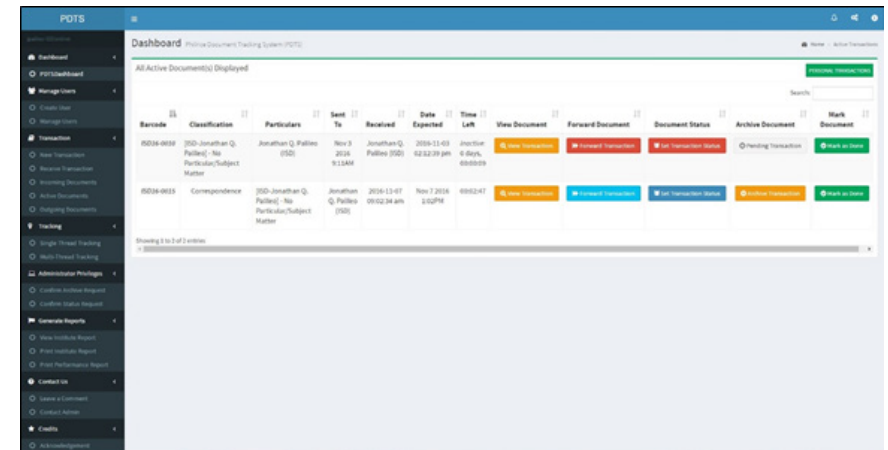


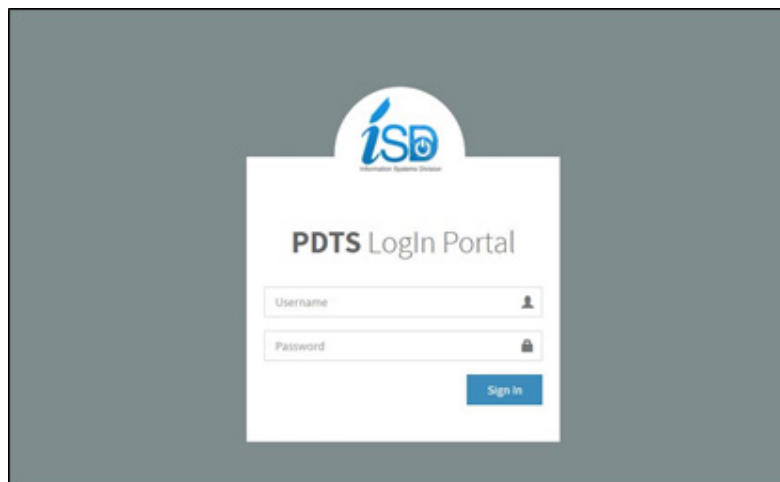
Figure 18. HRIS deployment and orientation in PhilRice Agusan and Negros.



**Figure 19.** PMS decomposition diagram. Projects profile (2.0) and Documents management (6.0) are the modules that is be prioritized.



**Figure 21.** PDTS Transactions module with new GUI design. Improved archiving, change of status, tracking of documents functions.



**Figure 20.** Login page of PDTS new version ready for beta testing by December 2016.



**Figure 22.** The IS Productivity Seminar Series “Gusto Namin Productive Users Kayo” at PhilMech.





**Figure 23.** IS Productivity Seminar Series, “Gusto Namin Productive IS Users Kayo!” at Branch Stations (Batac, Agusan, & Isabela).



**Figure 24.** Agri-Hackathon3 Symposium held on November 15, 2016.



**Figure 25.** Lakbay Palay Wet Season 2016 Registration & E-Raffle.

### III. Business Continuity

*Project Leader: LAI Tamani*

PhilRice as a government agency mandated to develop high-yielding and cost-reducing technologies for rice farmers and to preserve and convey rice related data, information and package of technologies to the right target users. Information systems infrastructure and services are needed by PhilRice to continue perform its mandate in both favorable and unfavorable scenarios. Risks, threats, and vulnerabilities are identified and managed all the time to continue operations. There should be a framework for building the Institutes resilience and the capability for an effective response.

ICT Security, Connectivity, Viability, and Disaster Recovery for Resiliency Consolacion D. Diaz, Luis Alejandro I. Tamani, Jovino L. de Dios, Victor Joseph Taylan, Christian U. Sicat

To ensure continuous operations and services, with no significant degradation in service, ICT resources must be secured. There is a continuous update of the PhilRice ICT Disaster Recovery Plan. Plan, procedures and guidelines are drafted for each resources.

Management and monitoring of ICT equipment, systems and application activities are done daily to ensure continuous operations.

#### Activities:

- Update of ISD Risk Assessment – inclusion of additional servers and services.
- Update PhilRice ICT Disaster Recovery Plan - DRP Guidelines and Procedures.
- Drafted Server room security policy.
- Drafted DRP guidelines.
- Crafted antivirus management guidelines.
- Developed installation and configurations procedures and standards.
- Network/System management and monitoring.
- Communication Subscription Lines.

#### Results:

- ISD Risk Assessment  
To perform regular information security network risk assessments for the purpose of determining areas of vulnerability and to develop appropriate preventive measures. The Risk Assessment Plan is updated to include new ICT equipment and other resources.
- PhilRice ICT Disaster Recovery Plan

The main focus of this document is to provide a plan to respond to a disaster that may damage PhilRice computer systems. This plan is designed to fast track the recovery when disaster occurs. The DRP was updated to include the new threats, solutions and best practices. The 2015-2016 ICT Best Practices and presentation was created. Drafted server room security policy and DRP, antivirus management guidelines.

- Network/System Management and Monitoring

#### *Firewall Management*

Firewall appliance monitor and filter network traffic. Firewall management and monitoring is done daily locally and remotely or as the need arises during weekends, holidays and after office hours. Licenses for 4 management modules installed in firewall appliance is renewed yearly. One year subscription cost for Web and Application Filter, Gateway Anti-Virus and Gateway Anti-Spam is Php35,000.00 each module and Php55,000.00 for IPS module. This modules blocks, clean and quarantine suspicious incoming files, data, activities. Summary reports from the firewall appliance can be generated. Reports generated are web and email viruses/usage, spam sender and recipient.

#### *Reports generated from firewall*

Website/webpages are one way that is used to spread viruses. There are websites that will/can attempt to automatically access your computers when you visit their sites. Unknowingly adware bugs are already installed in the computer. Firewall appliance can block web viruses from entering our system.

#### *Email Management and Monitoring*

There were about 200 million incoming and outgoing messages for the past 11 months from different email engines/domains, including spam messages received and delivered. In order for the legitimate incoming and outgoing messages to be received and delivered, the email server must be cleaned manually (remove/delete spam messages).

Email accounts of several staff were attacked as early as January. Some have given their username and password, others click links.

Compromised accounts are automatically put into maintenance status until the account is cleaned. Messages sent from compromised accounts are manually deleted from the server.

Messages with virus, reported as spam, contains files blocked by the system or exceeds allowed size are put to deferred, bounced or rejected.

- Communication Subscription Lines  
There are 83 Smart Postpaid Subscription Lines distributed to staff. ISD is in charge of the application for new connection based on the approved request and the preparation of monthly payments for individual accounts

### **Maintenance and Improvement of ICT Infrastructure and Communication (ISD-004-002)**

*LAI Tamani, CD Diaz, JL de Dios, VJ Taylan, CU Sicat*

- There are three MIS modules being managed and maintained (CoreMIS).
  - Financial Management Information System (FMIS) required 40 modifications made that addressed the reporting requirements of the Commission on Audit (COA), the Institute and other government agencies aside from the Nine new modules made. Testing and preparation for the integration of the FMIS to the document tracking system (PDTS) was started. The Budget Accounting System was modified for a more detailed budget system.
  - The Property and Procurement Information System (PSIS) made ten modifications to the system. Data cleansing is being done in preparation for its deployment to the branch stations. The Project Procurement Management Plan (PPMP) system was developed to cater to the PPMP preparation for the year 2017. The Annual Procurement Plan (APP) was also developed in conjunction with the PPMP.
  - The Human Resource Information System (HRIS) was accepted as completed based on the signed TOR (version 1). Initial installation was also made in the branch stations for the Attendance System through the use of biometric lox boxes.
- Network and Systems operations and maintenance
  - There are three corporate websites and internet servers maintained and managed with minimum downtime. Downtimes were mostly because of maintenance purposes or due to external factors such as downtime on internet service by the provider.

- All systems and servers are maintained for their optimum availability to users. The types and numbers of servers are: 4 production servers; 10 special purpose servers; and 10 development serves. Fifteen (15) multi-purpose servers deployed in the branch stations are also being maintained through online or travel to the station.
- The computer networks which composed of the wired and wireless connections were managed and monitored to minimize downtime. New ports and relocation of cabling were done to accommodate more users in the wired network. There are about 30 network switches, one firewall, two redundant core switch, and two routers maintained.
- A new wireless access scheme was introduced to integrate all the access points into single entry system and improve security. Initially, there are 335 wireless local area network users who registered 494 devices.
- The Local Area Networks of the branch stations are also maintained. A network firewall was installed at PhilRice Negros to increase their security and to be connected in the PhilRice virtual private network (VPN) connecting CES, Los Banos, Batac and Negros.
- The network firewalls of Los Banos, Batac and Negros were upgraded to newer firewalls for more secure connections.
- Internet connections maintained: CES – 2 direct internet and 2 DSL connections; Negros – direct internet; Batac, LB, Agusan – DSL; Bicol – Cable TV/internet; Isabela, Midsayap – wireless broadband.
- A new 8MBPS direct internet connection was subscribed for the Philippine Rice Information System (PRISM) project.
- An annual pro-active maintenance scheme was made and executed. 487 desktops and 144 mobile computers were served. Repair and maintenance were undertaken to maintain the serviceability of the computers and network equipment. New computers were configured and added to the network.
- Annual preventive maintenance and inventory of branch stations computers: Agusan-43, Bicol-15, CMU-7, LB-32, Negros-15, Batac-37, Midsayap-33 and Isabela-25
- The telephone network is also maintained with some additional local extensions added or moved upon request.



- The closed circuit television system (CCTV) is maintained. There are four CCTV cameras installed at the Future Rice Program farm to monitor farm activities; nine cameras for the main laboratory building; two at the main gate to monitor the going ins and outs; one each for the BDD, ABCRE, Motorpool entrance and PPMD.
- Institutional Support
  - Videoconferencing services were also provided to several events. These are mostly for communication to collaborating agencies and researchers.
  - Video streaming were also done during the National Rice R&D Conference and the Lakbay Palay. These were done to cater to online clients.

### **PhilRice Library Management (ISD004-003)**

*EEJoshi, VPSalvador, and MBSison*

As support to the rice research and development for improvement of rice productivity and help propel rice self-sufficiency, focused was on the capacity enhancement and knowledge sharing facilities and activities. This required availability and access to current scientific and technical literatures, and related materials. Access and continuous content upgrading of prints, websites, and other information systems infrastructures to serve on a 24/7 access basis is very essential. Library operation was supported strongly by an automated integrated library system developed internally.

Collection development was patron-driven allowing researchers to recommend materials for acquisition. Aside from printed books and journals, e-books and online journals were introduced as alternate format.

#### **Activities:**

- Developed and populated the WEB Online Public Access Catalog (WEB OPAC) with new resources for information storage and retrieval.
- Developed the collection through subscribed electronic/printed resources and devices for direct and indirect access to CES and PhilRice branch stations.
- Upgraded services through IT
- Strengthened awareness of resources through promotion and user training.

#### **Results:**

- Library website was continuously improved and updated with

the new online resources like Advances in Agronomy, Elsevier ebooks and with the current subscriptions of Proquest Agriculture, Gale databases (Powerpack Agriculture, GREENR, Expanded Academic ASAP), EBSCO Food Science Source & STM, OECD iLibrary, Springer, Taylor & Francis and Science Direct at [www.philrice.gov.ph/libraryweb/](http://www.philrice.gov.ph/libraryweb/) These databases were acquired under Project IPaD. Springer, Science Direct and Proquest Agriculture are the most used databases. Our in-house database XCardbox containing the library's reprint and journal article collection is updated daily for the inclusion of newly indexed articles, as well as editing of entries. Another feature of the website includes the helpdesk "Ask a Librarian" where queries and requests for publications are received and acted on.

- Acquisition of new materials, including publications for the branch stations: 6039.  
Our materials consist of: books, ebooks, journals, reprints, digital files, outsourced resources, and newspapers. Our outsourced resources of 275 articles were requested by researchers which we outsource from institutions and library networks. Digital files (3003) consist of downloaded items from databases and other free access resources.
- Destiny Library Manager which runs the Online Public Access Catalog (OPAC) was upgraded to version 12.  
Our licensed software for our OPAC has been upgraded incorporating RDA (resource description access) features.
- There were 345 books, reprints, and journals cataloged and inputted in the OPAC. This allowed online access to our clientele who can self-check on new titles. New books were also announced via email to PhilRice staff, AEWs, AgRiDOCS, and DA. Currently, borrowers who have checked our resources come to the library ready with the call number of books they intend to check out.
- Ebook downloads totaled to 459 with pdfs preloaded to tablets distributed to stations under IPaD. These provided ready reference to stations with subjects in plant breeding, soils, climate change, fertilizers, pests and diseases, gender, and other related subjects.
- Harvested materials from open access and copyrighted journals went to 3003 and stored in the digital library. Copyrighted materials cannot be freely shared online so the library main-

tains a digital collection which can be searched for requested materials, mostly rice articles.

- Circulated materials accomplished with 4517 borrowed items of books and journals. More books were borrowed compared to journals as several subscribed online full-text databases can be directly accessed.
- Current awareness in the form of the News Monitor was done and enhanced through the inclusion of links to news items, updated as frequently as sent by DA-Press Office. This is helpful in keeping updated on items published in our local newspapers and covers Philippine agriculture, and not limited to rice news.
- WEBOPAC usage went up to 271 (170%) with more researchers accessing the catalog.
- Outsourced resources totaled to 275 (291%) with requested of articles from staff and sourced from other libraries and institutions.
- 1004 articles were indexed and uploaded in the XCardbox database.
- 1799 news items on rice and PhilRice were clipped and mounted.
- Promotion through seminars (within and outside PhilRice), bulletin board posting, info tv posting of new books, and emails was done.
- Downloads to the subscribed online databases is at 24,704 (205%). Increase in downloads reflect the importance of literature needs of our researchers.
- Five (5) IT Seminars "Gusto Namin Productive IS Users Kayo" for PhilRice and Community Stakeholders were conducted in 2016 in CES, PhilMech, PhilRice-Agusan, PhilRice-Batac, and PhilRice-Isabela. Participants from PhilMech, Philippine Carabao Center, CLSU, NSQCS, PhilScat, LGUs, NIA, MMSU, INREC, and other agencies attended the seminars. Topics included: IPaD's enabling mechanism of online resources, predatory journals, Introduction to Philippine Rice Information System (PRISM), PhilRice Soil Information System, FutureRice: aerial imagery experiences, ICT security trends and best prac-

tices, Rice Data and Information Portal (DBMP), and ICT-based resources and tools (Pinoy Rice Knowledge Bank), information systems and databases, safety regulation and installation of electrical office equipment and computer maintenance.

- One institutional seminar "Rice: Seeing through the Lens of Drones and Satellites" was also conducted featuring "PRISM Technology & Online Portal" and FutureRice Aerial Imagery" under the Development Sector program.

### **PRiSM: Philippine Rice Information System - An operational system for rice monitoring to support decision making towards increased rice production in the Philippines**

*PhilRice, IRRI and sarmap*

The Philippine Rice Information (PRiSM) aims to establish a nationwide information system on rice that will provide information on rice areas and yield at a particular location and time. That information are very important for the Department of Agriculture for their planning and decision making. PRiSM relies on data from remote sensing, crop models, crop health surveys, and ground data to deliver actionable information on rice crop seasonality; area; yield; damage from flood, wind, or drought; and yield-reducing factors, such as diseases, animal pests, and weeds.

#### **Results:**

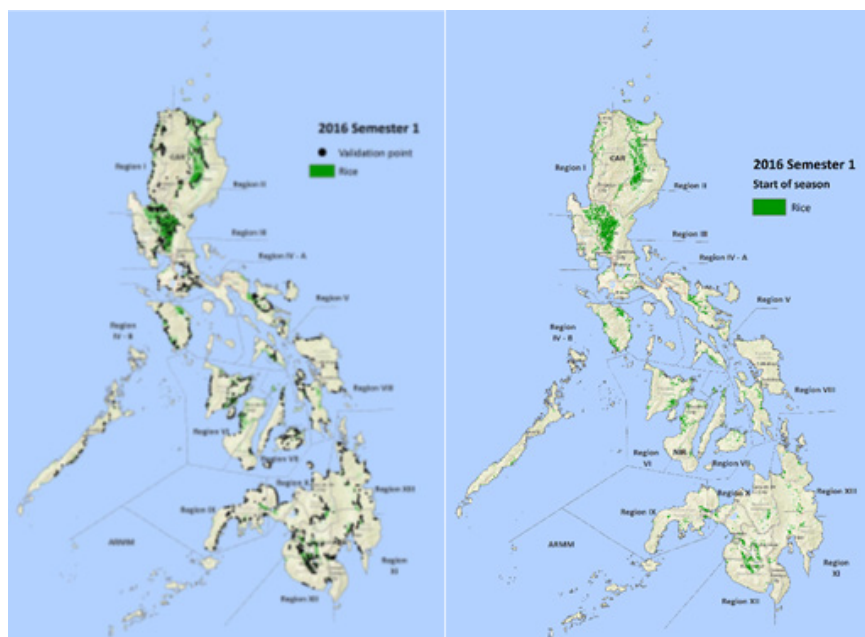
- Generated and validated 2016 1st semester start of season and rice area and maps (Figures 26). Based on the analysis of SAR data, the total area planted to rice for 2016 first semester covering at least 97% of the country was estimated at 1,891,501 ha with 86.3% overall accuracy based from 2,019 ground validation points (Figure 27). Table 4 shows the rice area estimates at regional level while provincial rice area estimates were also calculated.
- Generated and validated 2016 1st semester rice yield estimates for 16 regions (Table 5) was presented. The agreement of PRISM yield estimates (4.42 t/ha) with PSA (4.03 t/ha) data for 72 provinces is 85%.
- Developed and shared to the DA 6 monthly PRISM Bulletin from January to June.
- A total of 554 Synthetic Aperture Radar (SAR) images acquired from InfoTerra GmbH of the TerraSAR-X satellites and 286 SAR

- images from Sentinel 1A of the European Space Agency were processed used as illustrated in Figure 28.
- Organized and conducted the PRISM Annual Executive Meeting with officials from DA, PhilRice and IRRI, project partners and other agencies for effective reporting and product delivery.
- Conducted field testing and technical assessments of updated project protocols (5 protocols) and forms before deployment to regional implementers.
- Lead the conduct field damage assessments in 17 municipalities of Maguindanao, Zamboanga Peninsula, North Cotabato, Bukidnon and Bohol highly-affected by drought in the 2016 1st semester.
- Continued development of the web-based rice information system including functional website, user access management system, database management system of rice area estimates and maps, production situation, pest injuries, and yield estimates. The PRISM website launching and usability assessment was conducted in June 2016, participated by target users from DA, PhilRice, IRRI and project partners.
- Lead in the PRISM Sustainability in DA, PhilRice and DA RFOs through the conduct of planning workshops to develop national and regional sustainability plans, operations manual and work plans for the transition period and operationalization of PRISM Unit at PhilRice.
- 15 Trainings on PRISM protocols and forms conducted from March to June 2016.

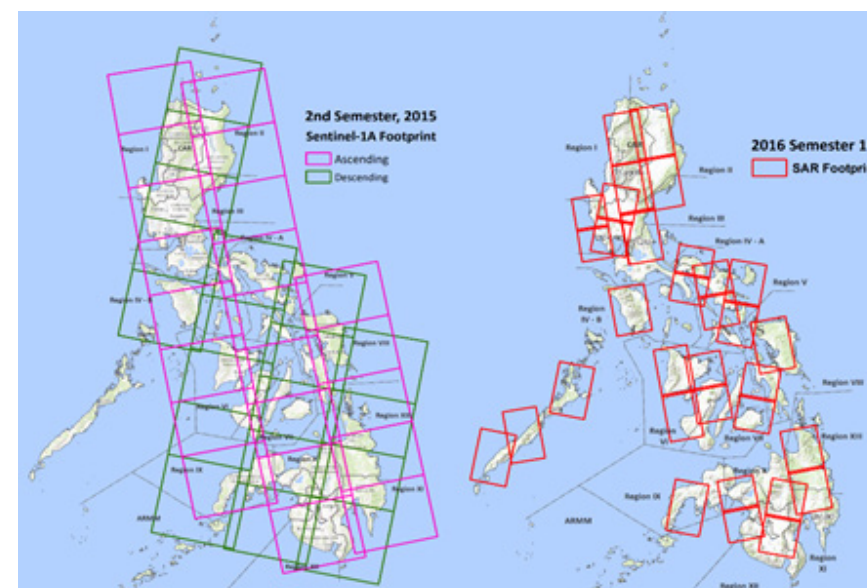


**Figure 26.** First semester 2016 start of season map derived from combined TSX and Sentinel-1A imagery. This map was processed using MAPscape-RICE®.





**Figure 27.** First semester 2016 rice area map derived from combined TSX and Sentinel-1A imagery with ground validation points. This map was processed using MAPscape-RICE®.



**Figure 28.** The PRISM monitoring fields during 2016 1st Semester implementation.

**Table 4 .** Estimates of rice area (ha) in the Philippines as estimated by PRISM processes, 2016 first semester.

Processes/ 2018 first semester

Region/Province	covered by combined footprints (%) <sup>1</sup>	Date of last image acquisition	Rice Area (ha)			No of validation points	Accuracy (%)
			Planted (PRISM estimate)	Harvested (PSA Record)			
				2015 1 <sup>st</sup> Sem	2014 1 <sup>st</sup> Sem		
CAR	100	30-Mar	57,720	44,605	44,551	96	81.3
REGION I	87	30-Mar	154,533	102,878	102,067	120	85.8
REGION II	99	30-Mar	294,873	313,270	311,063	140	81.4
REGION III	100	30-Mar	401,119	323,405	328,090	132	90.9
REGION IVA	100	30-Mar	50,040	58,736	56,761	120	85.0
REGION IVB	76	30-Mar	127,133	117,841	114,079	116	85.3
REGION V	100	25-Mar	132,226	169,592	171,555	111	85.6
REGION VI	100	25-Mar	166,738	218,328	220,587	150	90.0
REGION VII	100	20-Mar	42,780	49,333	49,939	130	86.9
REGION VIII	100	20-Mar	62,262	149,867	151,049	138	85.5
REGION IX	100	25-Mar	56,599	67,135	69,020	164	87.2
REGION X	100	20-Mar	59,567	72,005	73,058	126	85.7
REGION XI	100	27-Mar	45,698	49,339	52,569	120	92.5
REGION XII	100	27-Mar	128,828	133,857	141,602	128	88.3
REGION XIII	100	27-Mar	60,841	96,456	96,612	108	84.3
ARMM	80	27-Mar	50,544	95,920	115,148	120	82.5
All	97		189501	2062567	2097750	2,019	86.3

**Table 5.** Yield estimates by regions, 2016 first semester.

Region/ Province	Number of covered municipalities	PRISM estimate of rice yield	PSA yield estimate 2015 first semester	Agreement (%)
CAR	48	4.55	4.44	96
Region I	89	4.69	4.56	96
Region II	76	4.84	4.43	92
Region III	127	5.71	5.81	90
Region IVA	49	4.43	3.64	91
Region IVB	37	4.21	3.76	89
Region V	102	3.86	3.70	95
Region VI	130	3.00	2.92	96
Region VII	47	1.91	2.94	63
Region VIII	75	3.94	3.52	75
Region IX	40	3.30	3.88	82
Region X	44	4.35	4.23	80
Region XI	34	4.28	4.37	91
Region XII	35	2.53	3.69	65
Region XIII	47	3.49	3.18	89
ARMM	34	1.72	2.24	74
PHILIPPINES	1,014	4.42	4.03	85

## Abbreviations and acronymns

ABA – Abscicic acid  
 Ac – anther culture  
 AC – amylose content  
 AESA – Agro-ecosystems Analysis  
 AEW – agricultural extension workers  
 AG – anaerobic germination  
 AIS – Agricultural Information System  
 ANOVA – analysis of variance  
 AON – advance observation nursery  
 AT – agricultural technologist  
 AYT – advanced yield trial  
 BCA – biological control agent  
 BLB – bacterial leaf blight  
 BLS – bacterial leaf streak  
 BPH – brown planthopper  
 Bo - boron  
 BR – brown rice  
 BSWM – Bureau of Soils and Water Management  
 Ca - Calcium  
 CARP – Comprehensive Agrarian Reform Program  
 cav – cavan, usually 50 kg  
 CBFM – community-based forestry management  
 CLSU – Central Luzon State University  
 cm – centimeter  
 CMS – cytoplasmic male sterile  
 CP – protein content  
 CRH – carbonized rice hull  
 CTRHC – continuous-type rice hull carbonizer  
 CT – conventional tillage  
 Cu – copper  
 DA – Department of Agriculture  
 DA-RFU – Department of Agriculture-Regional Field Units  
 DAE – days after emergence  
 DAS – days after seeding  
 DAT – days after transplanting  
 DBMS – database management system  
 DDTK – disease diagnostic tool kit  
 DENR – Department of Environment and Natural Resources  
 DH L– double haploid lines  
 DRR – drought recovery rate  
 DS – dry season  
 DSA - diversity and stress adaptation  
 DSR – direct seeded rice  
 DUST – distinctness, uniformity and stability trial  
 DWSR – direct wet-seeded rice  
 EGS – early generation screening  
 EH – early heading

EMBI – effective microorganism-based inoculant  
 EPI – early panicle initiation  
 ET – early tillering  
 FAO – Food and Agriculture Organization  
 Fe – Iron  
 FFA – free fatty acid  
 FFP – farmer’s fertilizer practice  
 FFS – farmers’ field school  
 FGD – focus group discussion  
 FI – farmer innovator  
 FSSP – Food Staples Self-sufficiency Plan  
 g – gram  
 GAS – golden apple snail  
 GC – gel consistency  
 GIS – geographic information system  
 GHG – greenhouse gas  
 GLH – green leafhopper  
 GPS – global positioning system  
 GQ – grain quality  
 GUI – graphical user interface  
 GWS – genomwide selection  
 GYT – general yield trial  
 h – hour  
 ha – hectare  
 HIP - high inorganic phosphate  
 HPL – hybrid parental line  
 I - intermediate  
 ICIS – International Crop Information System  
 ICT – information and communication technology  
 IMO – indigenous microorganism  
 IF – inorganic fertilizer  
 INGER - International Network for Genetic Evaluation of Rice  
 IP – insect pest  
 IPDTK – insect pest diagnostic tool kit  
 IPM – Integrated Pest Management  
 IRRI – International Rice Research Institute  
 IVC – in vitro culture  
 IVM – in vitro mutagenesis  
 IWM – integrated weed management  
 JICA – Japan International Cooperation Agency  
 K – potassium  
 kg – kilogram  
 KP – knowledge product  
 KSL – knowledge sharing and learning  
 LCC – leaf color chart  
 LDIS – low-cost drip irrigation system  
 LeD – leaf drying  
 LeR – leaf rolling  
 lpa – low phytic acid  
 LGU – local government unit

LSTD – location specific technology development  
 m – meter  
 MAS – marker-assisted selection  
 MAT – Multi-Adaption Trial  
 MC – moisture content  
 MDDST – modified dry direct seeding technique  
 MET – multi-environment trial  
 MFE – male fertile environment  
 MLM – mixed-effects linear model  
 Mg – magnesium  
 Mn – Manganese  
 MDDST – Modified Dry Direct Seeding Technique  
 MOET – minus one element technique  
 MR – moderately resistant  
 MRT – Mobile Rice Teknoklinik  
 MSE – male-sterile environment  
 MT – minimum tillage  
 mtha<sup>-1</sup> - metric ton per hectare  
 MYT – multi-location yield trials  
 N – nitrogen  
 NAFC – National Agricultural and Fishery Council  
 NBS – narrow brown spot  
 NCT – National Cooperative Testing  
 NFA – National Food Authority  
 NGO – non-government organization  
 NE – natural enemies  
 NIL – near isogenic line  
 NM – Nutrient Manager  
 NOPT – Nutrient Omission Plot Technique  
 NR – new reagent  
 NSIC – National Seed Industry Council  
 NSQCS – National Seed Quality Control Services  
 OF – organic fertilizer  
 OFT – on-farm trial  
 OM – organic matter  
 ON – observational nursery  
 OPAg – Office of Provincial Agriculturist  
 OpAPA – Open Academy for Philippine Agriculture  
 P – phosphorus  
 PA – phytic acid  
 PCR – Polymerase chain reaction  
 PDW – plant dry weight  
 PF – participating farmer  
 PFS – PalayCheck field school  
 PhilRice – Philippine Rice Research Institute  
 PhilSCAT – Philippine-Sino Center for Agricultural Technology  
 PHilMech – Philippine Center for Postharvest Development and Mechanization  
 PCA – principal component analysis

PI – panicle initiation  
 PN – pedigree nursery  
 PRKB – Pinoy Rice Knowledge Bank  
 PTD – participatory technology development  
 PYT – preliminary yield trial  
 QTL – quantitative trait loci  
 R - resistant  
 RBB – rice black bug  
 RCBD – randomized complete block design  
 RDI – regulated deficit irrigation  
 RF – rainfed  
 RP – resource person  
 RPM – revolution per minute  
 RQCS – Rice Quality Classification Software  
 RS4D – Rice Science for Development  
 RSO – rice sufficiency officer  
 RFL – Rainfed lowland  
 RTV – rice tungro virus  
 RTWG – Rice Technical Working Group  
 S – sulfur  
 SACLOB – Sealed Storage Enclosure for Rice Seeds  
 SALT – Sloping Agricultural Land Technology  
 SB – sheath blight  
 SFR – small farm reservoir  
 SME – small-medium enterprise  
 SMS – short message service  
 SN – source nursery  
 SSNM – site-specific nutrient management  
 SSR – simple sequence repeat  
 STK – soil test kit  
 STR – sequence tandem repeat  
 SV – seedling vigor  
 t – ton  
 TCN – testcross nursery  
 TCP – technical cooperation project  
 TGMS – thermo-sensitive genetic male sterile  
 TN – testcross nursery  
 TOT – training of trainers  
 TPR – transplanted rice  
 TRV – traditional variety  
 TSS – total soluble solid  
 UEM – ultra-early maturing  
 UPLB – University of the Philippines Los Baños  
 VSU – Visayas State University  
 WBPH – white-backed planthopper  
 WEPP – water erosion prediction project  
 WHC – water holding capacity  
 WHO – World Health Organization  
 WS – wet season  
 WT – weed tolerance  
 YA – yield advantage  
 Zn – zinc  
 ZT – zero tillage



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