2020

PhilRice R&D Highlights

Genetic Resources Division

Contents

Genetic Resources Division

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EXECUTIVE SUMMARY

Rice genetic resources cover the diverse genetic materials among traditional varieties, wild relatives, and modern cultivars used as food and in agriculture in general. In addition to its direct use as food, these are reservoirs and sources of traits that are important in the development of high-quality rice varieties such as high yield, better nutrition, and resistance to both biotic and abiotic stresses.

The Genetic Resources Division (GRD) houses the PhilRice Genebank and leads the efforts on the collection and *ex situ* conservation of rice germplasm, in accordance with international Genebank standards. Our Genebank is the repository of rice genetic resources consisting of traditional cultivars, modern varieties, farmers' selections, elite breeding materials, and wild rice relatives in the Philippines, as well as foreign introductions. Thus, it ensures acquisition, conservation, and utilization of high seed quality of genetic resources to support breeding of new rice varieties. The division, through its Seed Technology Unit, also leads the internal field inspection and quality assurance of seeds produced by the PhilRice seed production unit.

With these goals, GRD operated in three major project components: (1) conservation and management of rice germplasm, (2) evaluation for biotic and abiotic stresses and grain quality of rice germplasm, and (3) seed quality assurance of the PhilRice seed production and seed stock. These three projects contributed in achieving the PhilRice strategic outcomes, namely: (1) increased productivity, cost-effectiveness, and profitability of rice farming in a sustainable manner; and (2) enhanced value, availability, and utilization of rice for better quality, safety, health, nutrition, and income.

The Germplasm Management System version 2.0 (GEMS 2.0), the division's in-house database, supports our commitment of continuously improving and innovating the management, centralization, and storage of genetic resource data. The improved version of the GEMS had added features for automation on managing germplasm active inventory and redesigned system architecture for Digital Object Identifier (DOI) adaptation. GEMS can now be accessed online by rice breeders and other PhilRice researchers for their seeds and seed data requests. A total of 3,227 germplasm accessions conserved at Genebank had been registered and assigned with DOI. DOIs are used as permanent unique identifiers in the context of the

EXECUTIVE SUMMARY

Global Information System of the International Treaty on Plant Genetic Resources for Food and Agriculture. To date, 7,268 of the 17,399 rice germplasm maintained at PhilRice Genebank are now properly identified accessions. These rice accessions were characterized for their agro-morphological characteristics. This year, 1,342 germplasms were distributed to different stakeholders for characterization, evaluation, reference, demonstration, direct use, and repatriation. Some of these accessions exhibited desirable traits such as early maturity, short plant height, long panicle, and heavy and long grains.

We have also initiated the establishment of DNA banking at PhilRice Genebank to conserve DNA of traditional rice varieties as future references. DNA fingerprinting was done to establish and clarify the varieties' identity for varietal improvement, potential production for export, and for application of Plant Varietal Registration and protection. Currently, DNA of 2,082 accessions is stored in both short-term (-20°) and long-term (-80°) storage conditions.

In collaboration with other research divisions at PhilRice, GRD coordinated the evaluation of the rice accessions against major biotic and abiotic stresses and also assessed the grain quality profile that could serve as sources of desirable genes for breeding of new rice varieties. With this initiative, 1,340 rice accessions were categorized as resistant to intermediate in response to blast disease, brown leafhopper, green leafhopper, salinity stress, drought stress, and with good grain quality.

PhilRice assuring the availability, access, and use of high-quality seeds is critical in increasing farmer's agricultural productivity. GRD served as the internal quality unit conducting and monitoring seed quality assurance from pre-harvest until post-harvest operations. A total of 87 inbred varieties from basic seed (BS) (56 varieties), foundation seed (18 varieties), and registered seed (13 varieties) were inspected in dry and wet seasons, with average field purity of 99.3%. Seed quality monitoring of carry-over seed lots of most BS varieties conducted showed 85% to 95% seed viability.

PROJECT 1

Conservation and Management of Rice Germplasm

Marilyn C. Ferrer

The project focused on the main valuable resources of PhilRice Genebank: seeds, DNA, and data. This ensured that potentially useful diversity of germplasm was collected, conserved, characterized, evaluated, and then made available for direct use and in support to breeding of new rice varieties. The project has three studies: (i) Seed conservation, characterization and distribution of rice germplasm; (ii) DNA conservation and characterization of rice germplasm; and (iii) Germplasm information management. To date, there are 17,399 registered rice germplasm collections maintained at PhilRice Genebank in which 7,268 are identified accessions. These conserved germplasms were characterized morphologically and some of these exhibited desirable traits such as early maturity, short plant height, long panicle, and heavy and long grains. This year, 1,342 varieties were distributed to different stakeholders for characterization, evaluation, reference, demonstration, direct use, and repatriation. Following this, regeneration was continuously performed to replenish seed stocks, and this year, 326 entries produced enough seeds and conserved. Currently, there were 4,180 rice accessions conserved at PhilRice Genebank available for distribution.

Aside from morpho-agronomic characterization, the project initiated the establishment of DNA banking to conserve DNA of traditional rice varieties (TRVs) at PhilRice Genebank for future seed reference. DNA fingerprinting was done to establish identity that is not only significant for varietal improvement and potential production for exportation, but also for future application on Plant Varietal Registration and protection. Currently, there are 2,082 available DNA stored in short-term (-20°) and long-term (-80°) storage. Partial diversity analysis showed that 36 TRVs were found to be closely related with another. On the other hand, seven TRVs exhibited the presence of allele/QTL of five important traits of biotic and abiotic stress resistance and grain quality based from 13 functional markers.

The management, centralization, and storage of data of all of these genetic resources were supported by its in-house database called 'Germplasm Management System version 2.0 (GEMS)'. Improvement of GEMS included: enriched datasets of germplasm data, added features for managing germplasm active inventory, and redesigned system architecture for Digital Object Identifier (DOI) adaptation. Furthermore, the GEMS can now be accessed online by the breeders and researchers at PhilRice for seeds and data requests. Moreover, a total of 3,227 germplasm accessions in the Philippines conserved at Genebank were registered and assigned with DOIs. DOIs are used as permanent unique identifiers in the context of the Global Information System of the International

Treaty on Plant Genetic Resources for Food and Agriculture. With all of these undertakings, including efforts for continuous improvement and innovations, this project clearly showed its contribution to the institute's goal of increasing productivity, cost-effectiveness, and profitability of rice farming in a sustainable manner.

Seed Conservation, Characterization, and Distribution of Rice Germplasm

Marilyn C. Ferrer, Jonathan Niones, Xavier Greg I. Caguiat, Teodora H, Mananghaya, Malvin D. Duldulao, Maria Cristina V. Newingham, Jose Mari Z. Nombrere, Jeric R. Castro, and Mary Ann M. Rañeses

Seeds conserved in the Genebank are expected to be of highest quality to achieve maximum longevity. Seed conservation has a vital role in the preservation of genetic variability, which includes activities on acquisition, conservation, regeneration, characterization, and distribution of rice germplasm. To date, there are 17,399 registered Genebank collections in which 7,268 were identified accessions. These conserved germplasms were characterized morphologically with some exhibiting desirable traits such as early maturity, short stature, dense panicles, and long grains. This year, 1,342 varieties were distributed to different stakeholders for characterization, evaluation, reference, demonstration, direct use, and repatriation. Following this, regeneration is continuously performed to replenish seed stocks, and this year, 326 entries produced enough seeds and conserved. Currently, there were 4,180 rice accessions conserved at PhilRice Genebank available for distribution.

DNA Conservation and Characterization of Rice Germplasm

Teodora E. Mananghaya, Marilyn C. Ferrer, Rachelle M. Conmigo, Nicca May M. Muñez, Dionicko R. Arceo, Malvin D. Duldulao, and Jonathan M. Niones

Philippine traditional rice varieties (TRVs) describe economically important traits such as aroma, wide range of tolerance/resistance to abiotic and biotic stresses, good eating quality, and nutritional value that provide sources of breeding programs and have potential for local and international market. Establishment of identity and diversity assessment of TRVs through DNA fingerprinting will not only be significant for varietal improvement and potential production for exportation, but also for future application on Plant Varietal Registration (PVR) and protection. DNA of 2,082 TRVs were extracted using modified CTAB method and banked in

short- and long-term storage conditions. A total of 1,054 TRVs were genotyped using 16 STR markers. Partial diversity analysis exhibited two major clusters at 0.13 similarity coefficient. Furthermore, 36 TRVs were found to be closely related and possibly similar with another (with similarity coefficient ranging from 0.87 to 1.00). Some varieties were grouped together like Anangka (Diket) Norte and Marunaw as well as PRRI005034 and PRRI005053. Molecular characterization of 738 TRVs was conducted using 15 functional markers for detection of specific traits. Seven TRVs exhibited the presence of allele/QTL of five important traits for biotic and abiotic stress resistance and grain quality. The data generated will be validated before uploading to PhilRice-GEMs database for breeding and research purposes.

Germplasm Information Management (GEMS)

Jonathan M. Niones, Malvin D. Duldulao, Marilyn C. Ferrer, Xavier Greg I. Caguiat, Ma. Cristina V. Newingham, Jose Mari Z. Nombrere, and Jeric R. Castro

The study underscored the management and administration of PhilRice Germplasm Management System (GEMS) to maintain accurate, reliable, and up-to-date germplasm information in support of the institute' rice improvement programs. The GEMS database can now be accessed online thru the PhilRice Intranet Portal for seeds and data requests. This breakthrough contributed to this year's increase in utilization of the conserved germplasm. The GEMS holds datasets related to more than 17,000 collections. Complete profiles of 57% (1,752/3,063) of priority Philippine traditional rice varieties are available for access upon request. Uploading of vast rice germplasm data coming from various studies and projects in the division was continuously made to complete the datasets. New system function was also deployed in support of the automation and management of handling seeds from active set storage. As a dynamic database management system, GEMS was recently redesigned to adopt the use of Digital Object Identifier. Additional 2,211 accessions were registered in the Global Information System of the International Treaty on Plant Genetic Resources for Food and Agriculture.

PROJECT 2

Evaluation for Biotic and Abiotic Stresses, Grain Quality, and Phytochemical Content of Rice Germplasm at PhilRice

Xavier Greg I. Caguiat

The PhilRice Genebank conserves rice accessions that are yet to be explored in terms of traits for biotic and abiotic stress tolerance, and grain quality. These accessions could serve as sources of desirable genes that serve as building blocks in developing improved and new rice varieties. The project aimed to evaluate the rice accessions against major biotic and abiotic stresses and assess the grain quality and phytochemical profiles of pigmented accessions and input the data in the database for use by various breeding groups and farmers. Results showed promising results for biotic and abiotic stresses. Biotic stresses focused on rice blast and tungro disease, and green leafhopper and brown planthopper for the insect pests. In 2020 dry season (DS), 306 rice accessions were evaluated for resistance to major rice diseases. Results showed that 207 and 51 entries had resistant and intermediate reactions, respectively, while 48 entries were susceptible to blast. All germplasm collections were susceptible to tungro under the induced method of evaluation. In 2020 wet season (WS), 640 rice accessions were evaluated resulting in 441 resistant entries, 32 entries with intermediate reaction, and 149 susceptible to blast disease. For insect evaluation: 44 rice accessions were resistant, 115 intermediate, and 302 susceptible for brown planthopper while 189 had intermediate reaction and 372 were susceptible to green leafhopper. For abiotic stresses: 16 tolerant rice accessions out of the total of 279 were evaluated in progressive drought stress at the field during the 2019 DS while 16 and 145 rice accessions had tolerant and moderately tolerant responses to salinity stress at seedling stage, respectively. Lastly, a total of 504 rice accessions were analyzed for grain quality wherein 214 were completely evaluated for milling recovery and physical attributes, and 479 for amylose content and 498 for gelatinization temperature. Among the entries, two samples passed all the standards for grain quality except for amylose contents (AC) (High). Among the entries with waxy to very low AC (glutinous-type), six samples passed all standards for milling recovery and physical attributes. Among the 479 samples completely evaluated for AC and gelatinization temperature (GT), 84 rice accessions passed both the preferred intermediate classification for AC and GT. Meanwhile, 237 were predicted to have tender texture when freshly cooked based on their AC and GT combination. Evaluation results were then validated and forwarded to the database for uploading and made available to end-users. These data could help breeders identify potential parent/donor lines for varietal development programs.

Evaluation of Rice Germplasm for Biotic Stresses

Juliet P. Rillon, Gilely DC Santiago, Keith Marielle B. Guarin, and Salvacion E. Santiago

Rice diseases can affect the quality and quantity of rice that cause profit loss to farmers. Rice germplasm possess useful genes for key traits such as resistance to major rice diseases. Resistant accessions can be used as parent materials for new rice varieties. In 2020, 696 accessions from PhilRice Genebank were evaluated for resistance to blast and tungro. Evaluation for blast resistance was done 30 days after sowing by examining the dominant lesion type and leaf area infected. For tungro resistance, the prevented disease infection was assessed 3-4 weeks after inoculation under the induced method, and 45 and 60 days after transplanting under the modified method. Results showed that among the rice accessions evaluated for blast resistance, 496 (71%) and 69 accessions (10%) showed resistant and intermediate reactions, respectively, while 131 accessions (19%) were susceptible. Under induced method, all accessions were susceptible to tungro. Low tungro disease pressure under modified field method was observed during the 2020 dry season evaluation of 306 accessions. A total of 199 germplasms showed resistant to intermediate against brown planthopper and green leafhopper. Further evaluation of these accessions is necessary to identify donors of disease resistance that can be used in the development of new rice varieties.

Evaluation of PhilRice Germplasm Collection for Grain Quality

Amelia V. Morales, Xavier Greg I. Caguiat, Marilyn C. Ferrer, Evelyn H. Bandonill, and Raffy B. Rodriguez

Aside from yield, resistance to pests and diseases, and agro-morphological characteristics, grain quality, which are also influenced by genotype, play an important role in the rice breeding program. Long to extra-long grain length and slender shapes are highly preferred, similar to those having low to intermediate amylose content (AC) which are expected to have tender cooked rice, indicating good eating quality. This year, 504 rice germplasm were received and 498 were analyzed for grain quality (GQ). Majority met the standards for brown rice, milled rice, and head rice recovery, and immature grains among the 214 rice germplasm evaluated for milling recovery and physical properties. However, only a few entries passed the standards for chalky grains, grain length, grain shape, and gelatinization temperature. Among the entries, two samples with collection nos. 1703 and 7394 passed all the standards for GQ except for AC (High). Among the entries with waxy to very low AC (glutinous-type), six samples with collection nos. 2148, 10882, 16248, 16263, 16742, and 16473 passed all the standards for milling recovery and physical attributes. Among the 479 samples completely evaluated for AC and GT, 84

rice germplasms passed both the preferred intermediate classification for AC and GT. Meanwhile, 237 were predicted to have tender texture when freshly cooked based on their AC and GT combination. The data generated provided important information through a computerized database system in the rice breeding program maximizing the use of rice germplasm as well as utilization for other purposes.

Evaluation of Rice Accessions in Response to Progressive Drought Stress

Jonathan M. Niones, Roel R. Suralta, Ricky Jay M. Gonzaga, and Via Ann C. Marcelo

Rice genetic resources in the Philippines possess unexplored and possible resistance/tolerant gene(s) that could be used in biotic and abiotic stresses breeding programs. A total of 279 rice accessions were evaluated in progressive drought stress at the field. Two hundred forty-three (243) rice accessions yielded higher biomass than susceptible check IR64 (0.15g) while 79 rice accessions yielded higher biomass compared with tolerant check NSIC Rc222 (0.28g). Moreover, among 279 rice accessions screened for drought under field condition, 195 were susceptible and 81 were tolerant. It is interesting to note that 16 out of 279 rice accessions demonstrated tolerance based on the biomass production in response to drought stress condition. These 16 accessions will be evaluated/ screened further to different levels of drought intensities using the line source sprinkler system.

Evaluation of PhilRice Germplasm Collection for Submergence and Salinity Stress

Xavier Greg I. Caguiat and Mary Ann M. Rañeses

Oryza sativa (rice) is one of the major staple crops of the Philippines and the world. Salinity stress is one of the major abiotic stresses in rice affecting yield. This study aimed to evaluate PhilRice germplasm against salinity stress at the vegetative stage. The experiment was conducted in the glass house. One hundred fifty one (151) rice genotypes were screened for salt tolerance at seedling stage in hydroponics system using IRRI standard protocol. In this experiment, FL478 and NSIC Rc222 were used as salt-tolerant and sensitive checks, respectively. Sixteen (16) entries were identified as tolerant and 50 were moderately tolerant. On the other hand, 34 and 51 were susceptible and highly susceptible, respectively. The tolerant and moderately tolerant could be used in breeding programs for salinity-tolerant varieties in the future. However, further validation is needed to confirm the presence of genes using molecular analysis.

Evaluation of Rice Germplasm for Rice Tungro Resistance at PhilRice Midsayap

Pernelyn S. Torreña and Victor Zeus B. Uyangurin

Rice tungro is the most destructive rice disease in Southeast Asia including the Philippines. The rice tungro virus (RTV) infects the plant at any growth stage, but most severe during the vegetative stage where symptoms are more pronounced. There were 230 germplasm evaluated for rice tungro virus reaction under modified screening method. Results showed that only six entries [EURIAN (515), DAYOYO (4336), MILAGROSA (4633), PARAY BATUKAN (4742), BUKID (5305), and LUBANG (11300)] showed intermediate reaction and the rest of the entries were rated resistant. However, RTV inoculum was low in the field resulting in low RTV infection.

Characterization of Root Elongation Responses of Philippine Traditional Rice Varieties under N Deficient Conditions

Jonathan M. Niones, Ricky Jay M. Gonzaga, Dionicko R. Arceo, and Cay Neth A. Callejo

Root system architecture is an important trait contributing to the increase in water and nutrient uptake that results in grain yield. The maximum seminal root length (MSRL) is a significant trait associated with high water-use and nitrogen (N)-use efficiency under non-stressed and water-deficient rice. This study assessed Philippine traditional rice varieties (TRVs) for root elongation trait under sufficient (500µM) and deficient (5µM) conditions of nitrogen (NH_4+) using hydroponics solution system. Three hundred sixteen out of 768 TRVs had the longest seminal root length ranging from 135 to 252mm under N-deficient conditions. For N-sufficient conditions, on the other hand, seven TRVs showed the longest MSRL of more than 167mm, higher than Kasalath check. It is interesting to note that more TRVs demonstrated long MSRL, which could be potential new sources of root elongation trait for breeding programs in response to N-deficiency in soil.

PROJECT 3

Seed Quality Assurance in PhilRice Seed Stock

Susan R. Brena

PhilRice is mandated to produce high-quality seeds and make them available on time. The Seed Technology Unit of the Genetic Resources Division serves as the internal quality unit doing seed quality assurance in the field and after harvest. The overall quality of the seed is affected by both pre-harvest and postharvest factors. Pre-harvest quality assurance was done through internal field inspection during 20 days after transplanting, maximum tillering, on-set of flowering, and 2 weeks before harvest. Each inspection per variety per seed class was done in three replications. For breeder seed production, an area measuring 20 hills x 25 hills or 500 hills per replicate was pegged with bamboo sticks, then inspected. For foundation (FS) and registered seed production (RS), 1,024 plants or 32 hills x 32 hills were pegged by bamboo sticks and inspected. In 2020 dry season (DS), production areas for breeder (26 inbred varieties), foundation (11 varieties), and registered seeds (6 varieties) were inspected. Three varieties in BS production (NSIC Rc 158, Rc 224, and Rc 308) were rejected owing to differences in plant characters. Average field purity was 99.78% in BS, 99.08% in FS, and 99.15% in RS. In 2020 wet season (WS), 36 BS, 7 FS, and 7 RS inbred varieties were inspected. Five BS varieties (NSIC Rc 158, Rc 238, Rc 352, Rc 506, and Rc 510) were rejected owing to differences in plant morphological characters. Average field purity was 99.55% in BS, 99% in FS, and 99.02% in RS.

After harvest, varietal purity test of BS was done after threshing, drying, and seed cleaning. Samples submitted by the researcher in-charge of BS production were assessed for presence of mixtures of other rice varieties. Determinants of off-types are grain shape, color, width, and presence and absence of awn. Carry-over lots of breeder seeds produced in previous seasons stored in Business Development Division warehouses were monitored for seed viability. Twelve BS varieties produced in 2020DS were assessed for varietal purity after threshing, drying, and seed cleaning. None of the varieties planted for BS passed nor can be considered FS. Most of the varieties were downgraded to either RS or CS, particularly after seed cleaning. Carry-over seed lots of BS were tested every six months. BS produced in 2018WS, 2019DS, and 2019WS were tested. Most of the BS varieties produced in 2018WS had very low seed quality. However, three varieties had 50% viability but remained below 80%. Four genotypes of female parental lines (IR58025A, IR68897A, PRUPTG101, and PRUP TG102), six male parental lines (IR34686R, TG201M, TG202M, IR71604R, IR73013R, and STR3), and two maintainer lines (IR58025B and IR68897B) produced and stored in PhilRice-Los Baños were assessed for seed quality. Results obtained in seed viability were variable depending on genotypes and production season and year.

To improve further basic seed production in PhilRice, land preparation should be strictly done one month following the PalayCheck recommendation. This will allow dropped seeds to germinate and will decompose in the process of land preparation.

Proper scheduling of crop establishment should be made. Long-maturing varieties should be established first followed by short-maturing varieties. This will facilitate all operations in the field particularly irrigation. Moreover, postharvest operations will likewise be monitored properly. Roguing, a key operation in the field for the removal of off-type plants, should be done on time from vegetative to maturity. Early removal of off-types may eliminate roguing at the ripening since this is the most difficult stage to remove off-types.

Internal Field Inspection of Seed Production Areas

Rachel C. Ramos, Jane B. Regalario, and Maria Celeste S. Natividad

Seed quality assurance begins in the initial quality of the seeds used, which can be evaluated in the field. In PhilRice, field inspection of inbred seed production is done by the internal seed quality unit of PhilRice. Inspection was done 20 days after transplanting, maximum tillering, on-set of flowering, and 2 weeks before harvest. During each inspection, three replication areas per paddy were done per variety per seed class. In 2020DS, 26 inbred varieties planted in breeder seed production (BSP), 11 in foundation seed production (FSP), and 6 in registered seed production (RS) were inspected. Three varieties in BSP (NSIC Rc 58, Rc224, and Rc308) were rejected owing to differences in plant characters. Average field purity was 99.78% in BS, 99.08% in FS, and 99.15% in RS. In 2020WS, 36 BS, 7 FS, and 7 RS inbred varieties were inspected. Five BS varieties (NSIC Rc 158, Rc 238, Rc 352, Rc 506, and Rc 510) were rejected owing to differences in plant morphological characters. Average field purity was 99.55%, 99%, and 99.02% in BS, FS, and RS, respectively.

Seed Testing of Buffer Stock and Carry Over Seedlots

Rachel C. Ramos, Jane B. Regalario, and Maria Celeste S. Natividad

PhilRice is mandated to produce seeds and make them available to client on time. However, not all seeds produced in a given season are disposed after certification. Those seeds that are not sold are stored in ambient condition under the Business Development Division (BDD) warehouse. Seed Technology Unit (STU) serves as the internal quality control of the institution for determining the quality of seeds produced, and quality of the seeds after storage. After harvest, varietal purity test of breeder seeds was done after threshing, drying, and seed cleaning. Samples submitted by the researcher in-charge of breeder seed (BS) production were assessed for presence of mixtures of other rice varieties. Determinants of off-types are grain shape, color, width, and presence and absence of awn. Carry-over lots of breeder seeds produced in previous seasons stored in BDD warehouse were monitored for seed viability. Twelve BS varieties produced in 2020 dry season (DS) were assessed for varietal purity after threshing, drying, and seed cleaning. None of the varieties planted for BS passed nor can be considered foundation seeds. Most of the varieties were downgraded to either registered seeds or certified seeds, particularly after seed cleaning. Carry-over seed lots of BS was tested every six months by the internal seed quality – STU. BS produced in 2018WS, 2019DS, and 2019 WS were tested. Most of the BS varieties produced in WS 2018 had very low seed quality. However, three varieties had 50% viability but remained below 80%. In addition, four genotypes of female parental lines (IR58025A, IR68897A, PRUPTG101, and PRUP TG102), six male parental lines (IR34686R, TG201M, TG202M, IR71604R, IR73013R, and STR3), and two maintainer lines (IR58025B and IR68897B) produced and stored in PhilRice-Los Baños were assessed for seed quality. Results obtained in seed viability were variable depending on genotypes and production season and year.

EXTRA-CORE PROJECT

Genetic Characterization of Pigmented Rice in the Philippines

Xavier Greg I. Caguiat, Marilyn C. Ferrer, Mary Ann M. Rañeses, Rodel M. Bulatao, Henry F. Mamucod, and Rochelle C. Huliganga

Twenty (20) pigmented rice accessions were collected from the Genetic Resources Division, PhilRice. The pigmented rice samples, composed of one black and nineteen red rice accessions, were analyzed for their total anthocyanin content (TAC), total phenolic content (TPC), total flavonoid content (TFC), DPPH-radical scavenging activity (DPPH-RSA), ABTS-cation radical scavenging activity (ABTS-CRSA), and ferric-reducing antioxidant power (FRAP). The pigmented rice samples had variable phytochemical properties (TAC, TPC, and TFC) and antioxidant activities (DPPH-RSA, ABTS-CRSA, and FRAP) that ranged from 41.9 to 549.3mg/kg for TAC, 0.40 to 3.08mg GAE/g for TPC, 0.86 to 5.80mg RHE/g for TFC, 0.59 to 5.87mg TE/g for DPPH-RSA, 0.65 to 5.62mg TE/g for ABTS-CRSA, and 0.74 to 5.07mg TE/g for FRAP. Among the samples, Immayocan (PRRI000529) showed the highest TPC, TFC, DPPH-RSA, ABTS-CRSA, and FRAP values while Kuragrag (PRRI000299) obtained the lowest. On the other hand, Kallong buwan (PRRI000295) had the highest TAC while Kabodit (PRRI000387) had the lowest.

Co-development and Transfer of Rice Technology

Marilyn C. Ferrer, Xavier Greg I. Caguiat, Malvin D. Duldulao, Jose Mari Z. Nombrere, Jeric R. Castro, and Mary Ann M. Rañeses

The efforts to increase rice production and productivity in Southeast Asia are challenged by the adverse effects of climate change. Local varieties from Southeast Asian countries may contain genes that are important for developing varieties adaptable to climate changes. Although local varieties are well adapted and tolerant to certain biotic and/or abiotic stresses, their productivity are relatively low compared with improved/modern varieties. This project facilitated the collaboration among institutions in the Southeast Asian countries in conservation and sustainable use of local rice varieties in order to meet the challenges of climate changes and food security. The overall objective of the project is to improve adaptation to climate change and enhance the food security of resource-poor farmers in Southeast Asian countries by strengthening the conservation and sustainable use of rice genetic resources; specific objectives are to (1) identify phenotypic and genotypic characteristics of local varieties from participating countries, (2) improve the productivity of local varieties in participating countries through the use of molecular markers and near isogenic lines (NILs), and (3) exchange improved/modern rice varieties among participating countries. The project was implemented by a consortium consisting of the Indonesian Agency for Agriculture Research and Development (IAARD) as the leading organization, and the Malaysian Agriculture Research and Development Institute (MARDI), the National Agriculture and Forestry Research Institute (NAFRI) of Lao PDR, the PhilRice of the Phillippines, and the International Rice Research Institute as the participating organizations. The 106 shared germplasm from the Philippines (25), Malaysia (28), Lao PDR (25), and Indonesia (28) were already conserved at the PhilRice genebank and were fully-characterized. Some of these germplasm exhibited desirable traits such as early maturity, short plant height, long panicle, and heavy and long grains. Among the modern varieties, IR 85627 had the longest panicle, TDK 8 had the longest and heaviest grain. Among the local varieties, on the other hand, Ea Non and Mak Yom from Lao PDR had the longest and heaviest grain, respectively; Bocao and Ca-Ong (White) from the Philippines had the longest panicle and the most number of grains per panicle, respectively; and Widas from Indonesia was the shortest.