Philippine Rice R&D Highlights 2013

GENETIC RESOURCES DIVISION

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GENETIC RESOURCES DIVISION

Division Head: LM Perez

Executive Summary

Genetic resources are considered as foundation of agriculture and a principal element of breeding and genetic improvement of crops, livestocks and other biological species. It is also the subject matter of any research endeavor spanning new discoveries of genes or traits to applications of new information or technologies as well as solving industry-related problems to mention a few. Thus, conservation and management of genetic resources is a must, a priority and its importance is unparalleled for any research and development institution like PhilRice.

In rice, a total of 13,286 germplasm collections are currently kept in long term (-18C) and medium term (10C, 40% RH) storage facilities at PhilRice Genebank. Around 54% (7,129) have assigned unique germplasm accession ID based on standard germplasm conservation procedures. New germplasm collections in 2013 totaled to 537 consisting of breeding lines and research materials (376), traditional cultivars (158), and new released rice varieties by the National Seed Industry Council (NSIC) of the Philippines (3). Regeneration of germplasm with low viability and/or low seed stocks for distribution included 2751 collections. The materials were planted in the field (Block V) during the 2013DS and WS. In the same area and set-up, characterization of 1065 rice germplasm was conducted using 58 standard rice descriptors spanning vegetative, reproductive and postharvest crop stages in 2013. Most of the germplasm characterization was carried out during wet season (ideal season) except for few collections that were planted (for regeneration) and characterized during the dry season. All information was subsequently uploaded in the GEMS database.

Conservation of rice germplasm is a continuous process. This includes registration of incoming (new) germplasm collections, preparation of seed files (for seed verification/identity), seed cleaning, viability test (germination rate), slow drying of seeds to achieve 6% seed moisture content (MC), and packaging in standard foil packets for storage in medium term (active collections) and duplicated in long term (base collection) storage facilities of PhilRice Genebank. Except for registration and preparation of seed files, the rest of the processes mentioned are being done on a routine basis in all germplasm collections for regeneration. The latter is also considered as routine procedure in germplasm management in order to keep seeds viable with enough stocks for distribution to researchers/stakeholders. Incoming germplasm collections also include those rice genetic resources from the branch stations for duplicate storage in PhilRice CES. In 2013, a total of 3083 collections have been processed. As part of the continuous effort to strengthen the management and conservation of genetic resources,

we conducted germplasm inventory (physical) in order to determine the real status of rice collections in terms of identity (verifying with original seed files), viability, and availability of stocks for distribution. Stocks of germplasm accessions PRRI000914 to PRRI002999, consisting of 3532 seed packets, were extracted from the drying room, at medium-term and long-term storage conditions, for inventory. Of the 2084 accessions listed in the database and processed for inventory, only 1707 seeds were obtained in storage while 377 were missing. It is possible that these accessions have been misplaced or were not properly tracked by GEMS on its current location at the PhilRice Genebank. Around 65% (1355) were verified indicating correct identity of the germplasm while the rest are mismatched with the original seed files (seed identity is a problem) or do not have seed files. From the current 7129 accessions at the PhilRice Genebank, 42% have been processed in germplasm inventory and the rest will be completed in 2014.

Utilization rate of rice germplasm significantly increased from 57 in 2012 to 647 accessions/collections requested by researchers within and outside PhilRice, students (undergraduates/graduates), as well as international seed requests. Main purpose of the seed requests was breeding and genetic studies while the others were for physiology, allelopathy, phytochemical studies as well as for photoshoots by the Center for Culinary Arts Manila and exhibits of National Museum in Manila. Around 179 germplasm data were requested by researchers. Tracking system on seed/data requests has been in place to monitor utilization. During the late 2013, we implemented the use of PhilRice Material Transfer Agreement for Germplasm under Development (PMTA-GUD) for seed requests involving PhilRice breeding lines. This document is an attachment to the Standard Material Transfer Agreement (SMTA) as part of our obligation to the FAO Treaty.

Upgrading of GEMS database software from Filemaker 6.0 (old) to Filemaker Pro Advanced 12.0v3 (new) has been completed. New database commands and functions were employed for more efficient data management/retrieval and to facilitate response to seed/data requests within 1-2 days from receipt of request. Currently, we are initiating the installation of barcoding system for faster and efficient updating of germplasm inventory, viability status and seed distribution.

To further appreciate the immense diversity of rice genetic resources and enhance utilization among PhilRice researchers, we initiated the “GRD Walk-through Visit/Field Tour” in PhilRice CES Block V area where we established new and conserved germplasm materials for regeneration and characterization in 2013DS. The activity has been proposed to be a routine field day, also conducted in 2013WS, on rice genetic resources of PhilRice with focus on diversity of traditional cultivars in the country. Participants included plant breeders and other researchers from different R&D divisions and branch stations of PhilRice.

Evaluation of rice germplasm for tolerance to biotic and abiotic stresses and grain quality is an important component in genetic resources conservation and is necessary to enhance utilization of genetic materials for research and other purposes. In 2013, 284 germplasm were evaluated and none was resistant to BPH and GLH. Two accessions, PRRI001593 (PANDAN) and PRRI002941 (PALAWAN), were resistant to tungro indicating candidate sources of new genes for resistance to the disease. Screening for drought tolerance based on controlled line source sprinkler system identified 3 germplasm, PRRI001951 (P7-3-1), PRRI004381 (Arabon) and PRRI001034 (Baksalan Kawalwal), with consistent high shoot biomass at different intensities of progressive drought stress during 2013DS. Other accessions showing potential source of gene for drought tolerance included PRRI001037 (M5), PRRI001038 (M45), PRRI001014 (Binato), PRRI002324 (Binintanag), and PRRI000593 (Belibod). Further studies are currently being done to confirm results and determine mechanism of tolerance to drought stress. In terms of grain quality, 38 out of 609 accessions evaluated had superior head rice recovery (grade 1 to premium), less than 5% chalkiness, long and slender grain, and apparent soft to intermediate cooked rice texture.

In 2013, collaborative activities on germplasm conservation and evaluation in PhilRice branch stations were started. Inventory of rice genetic resources kept in PhilRice Batac included 165 traditional varieties collected from upland, saline and submerged rice areas as well as highland irrigated rice areas from 2011-2013. Participatory varietal evaluation of the traditional varieties by farmers in Currimao, Ilocos Norte showed that the most preferred varieties in terms of productivity and comparable yield with NSIC Rc9 were Dinorado, Isic Pugot and Balsamo B. In PhilRice Isabela, the draft of the germplasm catalog containing 59 traditional varieties with photos and agro morphorphological characteristics has been completed. .

In addition to conservation and management of germplasm, genetic resources research is another core function of the division focusing on genetic diversity research, application of advanced molecular biology protocols toward novel gene discovery for traits relevant to rice research and development. The development of genetic mapping population as a platform resource for breeding and genetic improvement of rice was initiated using 8 Philippine traditional varieties as founder lines. Agro-morphological traits of the 8 founder lines were diverse and showed potential sources of genes for resistance to drought, tungro, sheath blight, and bacterial blight of rice. A otal of 28 single intercrosses with 21 F1 plants made based on half diallel mating scheme of MAGIC. Identifying molecular markers for hybridity testing of true F1 progenies is underway. This will be used to advance selected F1 plants to G2 (second generation of crosses). Other applications of molecular markers for the improvement of germplasm conservation procedures included DNA fingerprinting of seed files and corresponding seed stocks from medium and long term storage of 92 selection rice accessions. Results indicated that 33 showed correct seed identity in terms of 100% similarity of DNA fingerprints between seed files and seed stocks conserved. DNA fingerprints of the rest of the materials are being confirmed further by polymerase chain reaction (PCR) and genetic similarity analysis.

I. Conservation, Characterization, and Distribution of Rice Germplasm

Project Leader: MC Ferrer

The abounding diversity of rice in the Philippines is a national heritage that must be highly valued. These rice genetic resources possess vast wealth of desirable genes that serve as one of the most important raw materials in meeting the current and future needs of rice improvement as well as production programs. Maintaining biodiversity for food and agriculture is a national responsibility and cooperative efforts are needed to halt genetic erosion. Its preservation is of paramount importance as this germplasm is a repository of useful genes for plant scientists to solve future problems.

In the effort to preserve biodiversity, there has been a concerted world effort to explore, collect, conserve and document the genetic diversity of this important germplasm before they are lost forever. Genebanks enabled the conservation of these materials ex-situ to ensure seed availability and survival. Genebanking provides a safe storage system for these germplasm materials where they can also be systematically and sufficiently characterized. Rice germplasm conservation activities involve manual processing of dried materials for permanent packaging and medium-term storage. Processing includes manual sorting to remove all inert and damage materials as well as separate mixtures. Identities will be cross-referenced against the original seed and panicle files. A properly managed and well-characterized germplasm collection will attract an intensified utilization by breeders, leading to more diverse and better designed varieties which are the key technology in high productivity rice farming. As more information is available about the germplasm, the wider selection and diversity of materials can be made available for use in the breeding program and for future generations to appreciate.

In all these undertakings, however, with the advent of the Plant Variety Protection Act, legal instrumentalities, such as the Standard Material Transfer Agreement (SMTA), will be instituted for the protection of the Philippine rice genetic resources.

Collection and acquisition of new germplasm materials

IG Pacada and MC Ferrer

The collection of traditional cultivars and indigenous germplasm grown in various rice areas and deposited in a national genebank (PhilRice Genebank), will facilitate protection of genetic wealth as well as safeguarding Philippine germplasm's rich diversity. Our main goal in this study is to collect and acquire traditional/landraces cultivated in upland, irrigated, and rainfed areas, PhilRice-bred lines, breeder seeds, breeder collections collected locally and abroad.

Highlights:

- A total of 537 new collections were acquired consisting of breeding lines and research materials (376), traditional cultivars (158), and new released rice varieties (3) (Figure 1).
- The origin of newly-acquired traditional cultivars is shown in Figure 2. Collection of these cultivars was facilitated by the Department of Agriculture (DA) and DA-RFU III funded projects, some PhilRice researchers, farmers, as well as by Usec. Dante S. de Lima.
- Passport data of individual new collections based on available information were consolidated using the collecting data form.

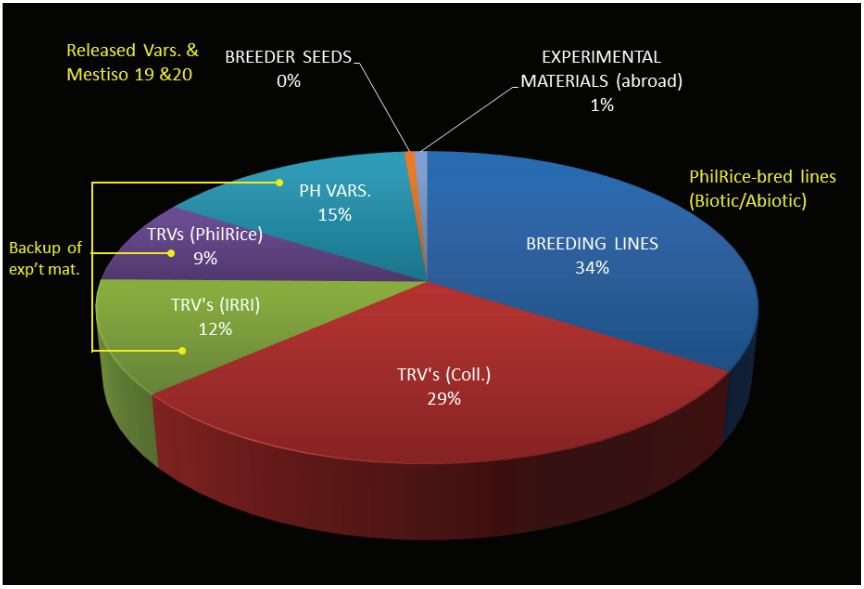

Figure 1. Percent distribution of newly acquired germplasm in 2013

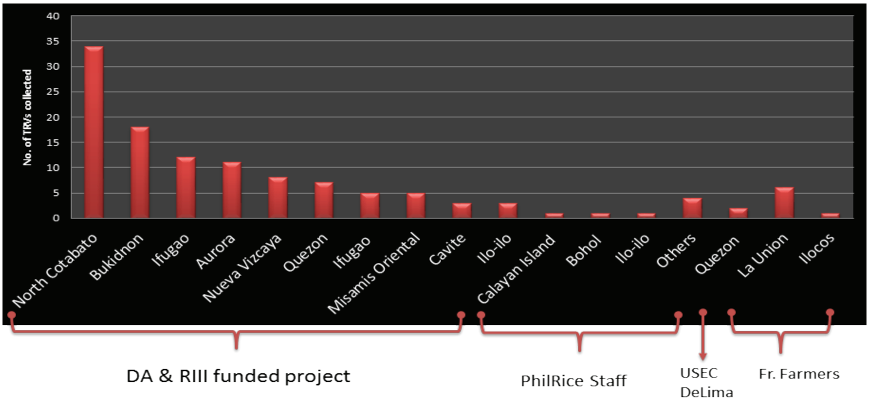

Figure 2. Number of traditional cultivars collected and their source provinces.

Regeneration and conservation of rice germplasm

MIC Calayugan, CQ Cortaga, DA Saclangan, CL Diaz, MC Ferrer, and LM Perez

Philippine traditional rice varieties and landraces are being lost through genetic erosion. Farmers adopt new varieties and cease growing varieties that they have nurtured for generations, eventually losing these varieties in the end. Breeding programs need the genetic variation from traditional varieties and landraces to cope with the many biotic and abiotic stresses that challenge rice production. There is, therefore, an urgent need to safeguard this germplasm for its present and future use. Ex situ conservation provides a safe storage system for this germplasm where it is kept under optimal storage conditions efficiently managed and made accessible to users. Through active seed distribution, the amount of stock depletes and as seed viability decreases over time, regeneration is necessary to restore stocks. Regeneration thru seed multiplication is the most crucial way to revitalize stocks in germplasm collections. This activity is best conducted during the dry season in order to ensure quality and sufficient seeds for conservation and utilization. The objective of the study is to conserve rice germplasm for present and future use and to regenerate sufficient and viable stocks for storage and distribution.

Highlights:

Regeneration

- A total of 2,751 collections were selected for regeneration in 2013 cropping seasons (Table 1). The germplasm was selected based on the level of viability or germination rate and seed stocks.

- Germination rate of the germplasm sown was 76% or 2,082 entries were used in regeneration of stocks. However, the number of entries with sufficient harvest in the two cropping seasons (DS and WS) was 1595 (77%) of the total regenerated entries. The 33% with less harvest will be scheduled again for seed increase.

- To facilitate information campaign on existing diverse rice genetic resources and to enhance utilization of rice germplasm, we conducted walk-through visits/field tours in the GRD experimental field where regeneration of germplasm including traditional varieties and improved cultivars were planted. In 2013, 2 walk-through visits were conducted at GRD experimental field, 1 in DS 2013 and 1 in WS 2013. Participants included PhilRice Executive Director Eufemio T. Rasco Jr, PhilRice breeders, researchers, students and individuals interested in diversity of rice genetic resources (Figure 3).

Conservation

- A total of 3083 accessions/collections from 2012-2013 were processed for conservation. The materials included those for drying to 6% seed moisture content (MC) as well as germplasm materials processed for storage (Table 2).

- 481 accessions/collections are being subjected to slow drying condition in a container with silica gel at 15oC and 40% RH, while 2602 accessions/collections were vacuum-packed in foil packets and stored in the medium and long term storage.

- Regenerated materials from 2013 WS which included 628 accessions/collections are also being processed for conservation.

- Reinventory and checking of seed packets of germplasm collections (earlier of 2012) contained in paper envelopes and stored in jars in the drying room were initiated to facilitate verification, re-viability testing, and drying with silica gels (if needed), and foiling for active and base storage.

- A total of 2241 accessions/collections including original 2004 collections retrieved and regenerated germplasm in 2008, 2010, 2011, 2012, and 2013 went through viability testing. Some collections stored in Base storage were processed for updating of viability status (Table 3).

- Viability data showed 83.4% (1869) were ≥85% indicating high viability while 16.6% (372) showed < 85% indicating that the latter are candidates for regeneration.

Table 1. Summary of regenerated rice germplasm in 2013 dry and wet season.

Season	Germplasm type	Total sown	Live	Sufficient harvests (>500 g)
2013DS	New collections	489	276	1193
	Low viability/depleting stocks	1572	1178	
2013WS	New collections	82	72	402
	Low viability/depleting stocks	608	556	
Total		2751	2082	1595

Figure 3. Genetic Resources Division walk-through visit/field tour in 2013 WS.

Table 2. Summary of processed rice accessions/ collections for 2013.

YEAR	No. of accessions/ collections under processing/ drying	No. of accessions/ collections vacuum packed in foil and stored
ORIGINAL/ NEW COLLECTIONS		
2013	112	417
2012	-	116
2011	-	1
2008	-	36
1996	-	3
REGENERATED MATERIALS		
2013 DS	369	1085
2012	-	537
2011	-	178
2010	-	219
Below 2010	-	10
TOTAL	481	2602
OVERALL TOTAL		**3083**

Table 3. Summary results of viability tests conducted in 2013.

YEAR	SEASON	HIGH VIABILITY (=85%)	LOW VIABILITY (<85%)	FOR REINVIGORATION/ SOWING
2013	ORIGINAL*	258	159	112
	DS	1032	25	397
2012	DS	75	2	0
	WS	266	31	0
	ORIGINAL	8	21	0
2011	DS	20	0	0
	WS	3	2	0
2010	DS	2	1	0
	WS	2	2	0
	ORIGINAL	53	2	0
2008	ORIGINAL	42	32	0
2004	ORIGINAL	13	73	0
BASE COLLECTIONS DIFF. SEASONS**		95	22	0
TOTAL		**1869**	**372**	**509**
OVERALL -> TOTAL ACCESSIONS/COLLECTIONS TESTED/FOR TESTING				**2750**
% HIGH/LOW VIABILITY		***83.4***	***16.6***	

*Original collections are the newly acquired and original seeds.

**1995 DS, 1997DS and WS, 2007 DS, 2008 DS and WS, 2009 DS

Germplasm distribution and information management
CQ Cortaga, MD Duldulao, DA Saclangan, and MIC Calayugan

In the effort to preserve biodiversity, there has been a concerted world effort to explore, collect, conserve, and document the genetic diversity of these important germplasm before they are lost forever. The PhilRice Genebank conserves diverse collections of rice germplasm acquired all over the country and also documents their important data/traits. This includes germplasm passport data; germplasm agro-morphological characterization data; grain quality, biotic and abiotic stresses evaluations data; viability condition; and inventory of each accession/collection in storage. All of these data are being stored in the Germplasm Management System (GEMS) database of PhilRice Genebank. Through this, germplasm availability for distribution and request of various germplasm data are facilitated. Germplasm distribution is an important function of any genebanks for the utilization of genetic resources. PhilRice Genebank regulates the release of seeds for utilization and facilitate material exchanges based on stipulations agreed upon in Standard Material Transfer Agreement (SMTA) between PhilRice and receiving party and vice versa. Germplasm data request is being offered to rice breeders, researchers, individuals, and stakeholders for their germplasm data/traits of interest. While an electronic database system exists, proper filing/bounding of all monitoring notebooks and raw data sheets are done for future references and as back-up files.

Highlights:

- One of the major functions of PhilRice Genebank is providing seeds and important germplasm data to researchers and rice stakeholders for utilization in research and education. In 2013, 25 seed requests with a total of 647 accessions/collections have been served to both PhilRice and non-PhilRice individuals. The purpose of such requests was mostly intended for breeding/genetic studies (Table 4).

- In terms of request for germplasm information, 7 data requests were catered and provided to PhilRice and non-PhilRice individuals for research and educational purposes (Table 5).

- To properly document release and receipt of germplasm, 11 Standard Material Transfer Agreements (SMTA's) covering 263 varieties were issued, 4 of which covered non-PhilRice Genebank materials (Table 6). SMTA is being used to protect intellectual properties or rights over the rice varieties being provided to non-PhilRice staff.

- A total of 22 SMTA's from IRRI for the seeds requested by PhilRice researchers were accepted by PhilRice through the GRD Head and is currently being monitored (Table 7). Some of these germplasm transfers from IRRI have additional IRRI-MTA attachments such as OMTA and CMTA for materials classified as non-sensitive and sensitive germplasm, respectively.

- A PhilRice Material Transfer Agreement for NCT Field Performance Tests of Rice (PMTA-NCT) has been issued for the NCT seeds planted at IRRI experimental fields during 2013 WS.

- In addition to the existing Material Transfer Agreements (MTA's) used in various PhilRice germplasm transfers, GRD created a PhilRice Material Transfer Agreement for Germplasm under Development (PMTA-GUD) for seed requests involving PhilRice breeding lines.

- Upgrading of GEMS database software from Filemaker 6.0 (old) to Filemaker Pro Advanced 12.0v3 (new) and employing new database commands and functions for more efficient data management/retrieval is currently being done. All germplasm data stored in the old software were transferred already to the new one.

- Installation of barcoding system is also currently being done for faster and efficient updating of germplasm inventory, viability status and seed distribution.

- Uploading of germplasm data included evaluation for salinity tolerance of 86 genebank accessions/collection conducted in 2011 WS. New grain quality information of 1007 genebank materials has been turned over for GEMS uploading.

- The GEMS (new) which contains various important rice germplasm data was updated with 2012 WS agro-morphological characterization of 100 entries as well as inventory data of verified PRRI000001 – PRRI003000 germplasm materials.

Table 4. Seed requests received and processed in 2013.

2013-GBSR-	REQUESTED BY/AGENCY	NO. OF MATERIALS AND BIOLOGICAL STATUS	PURPOSE OF REQUEST
0001	Vicky Lapitan / PhilRice L.B.	26 traditional varieties	Seed increase and research
0002	V. Dalusong / PhilRice	11 traditional varieties	Genetic study
0003	N. Lucob / PhilRice	1 traditional variety	Physiological study
0004	Julius Alvero / Visayas State University	15 traditional varieties	Image processing thesis
0005	Åsmund Bjørnstad / Norwegian University of Life Sciences	15 traditional varieties	Genetic study
0006	R.M. Cabanting / PhilRice	1 traditional variety	Genetic study
0007	L. Perez / PhilRice	10 traditional and advanced cultivars	Pest resistance
0008	R. Undan / PhilRice	50 traditional varieties	Photoshoot
0009	T. Padolina / PhilRice	3 advanced cultivars	Genetic study
0010	Ma. Veritas Luna / Center for Culinary Arts Manila	50 traditional varieties	Photoshoot
0011	Ricky de Guzman / Ilocos Norte	1 advanced cultivar	Seed increase
0012	R.M. Cabanting / PhilRice	6 traditional varieties	Genetic study
0013	A. Agustin / PhilRice	5 traditional varieties	Genetic study
0014	Nanette Galang – Gana / Dr. G. Galang Foundation	5 traditional varieties	Seed increase/therapeutic use
0015	V. Dalusong / PhilRice	228 EQR varieties	Grain quality studies
0016	V. Dalusong / PhilRice	1 traditional variety (3 types)	DNA fingerprinting
0017	R.M. Cabanting / PhilRice	32 traditional varieties	Profiling / seed multiplication of trad. vars. for export
0018	A. Palanog / PhilRice – Negros	100 traditional varieties	Allelopathy studies
0019	N. Lucob / PhilRice	15 traditional varieties	Calibration of raisedbeds for drought screening
0020	R. Millas / PhilRice	32 traditional varieties	DNA fingerprinting of TRV's
0021	M.I. Calayugan / PhilRice	8 traditional and advanced cultivars	MAGIC in PhilRice G.R.
0022	MC.V. Newingham / CLSU	5 traditional varieties	study on waxy gene presence in TRV's
0023	Raymond Emmanuel A. Pineda / UP Manila	1 commercial variety	Undergraduate thesis on effects of drought on different developmental stages of NSIC Rc288
0024	N. Lucob / PhilRice	2 traditional varieties	for QTL analysis on the plasticity of root traits in response to drought stress in rice
0025	R.M. Cabanting / PhilRice	24 traditional varieties	for phytochemical extraction of TRV's with anthocyanin pigment on leaves and alleged medicinal properties
TOTAL		**647**	

Table 5. Germplasm data requests received and processed in 2013.

2013-GBDR-	REQUESTED BY/AGENCY	DESCRIPTION OF DATA REQUESTED	PURPOSE OF REQUEST
0001	Sophia Marie Cuevas / PhilRice L.B.	Agro-morphological data, accession basic information, and evaluation data of all traditional varieties in the Genebank	Research/anthropological study
0002	G. Valida / PhilRice	Agro-morphological data, accession basic information, and evaluation data of all traditional varieties screened for abiotic stresses (94 accessions/collections)	Research
0003	M.C. Julaton / PhilRice	Accession basic information of submitted seeds for drought screening (30 accessions/collections)	Research
0004	Ma. Veritas Luna / Center for Culinary Arts Manila	Accession basic information, Agro-morphological characterization at harvest/postharvest stage, Grain quality evaluation data (50 accessions/collections)	Instruction/Education
0005	A. Agustin / PhilRice	5 accessions with highest number of spikelet per panicle (as of June 2013)	Research
0006	H. Badival / DA-CARFU	Accession basic/collecting info, agro-morph and physio-chemical stresses data of all materials collected in CAR	Documentation purposes
0007	V. Dalusong / PhilRice	Accession basic/collecting info of all PSB and NSIC varieties stored in the Genebank	Documentation purposes

Table 6. SMTA issued to seed requests received from non-PhilRice individuals in 2013.

2013-GRDIn-SMTA-	REQUESTED BY/AGENCY	NO. OF MATERIALS AND BIOLOGICAL STATUS	PURPOSE OF REQUEST
0001	Julius Alvero / Visayas State University	15 traditional varieties	Image processing thesis
0002	Åsmund Bjørnstad / Norwegian University of Life Sciences	15 traditional varieties	Genetic study
0004	David Raitzer / IRRI	15 advanced cultivars*	Genetic study
0005	Ma. Veritas Luna / Center for Culinary Arts Manila	50 traditional varieties	Photoshoot purposes
0006	Alvaro Pamplona / IRRI	25 breeding lines*	Genetic study
0007	Mary Ann Inabangan / IRRI	10 breeding lines and 8 advanced cultivars*	Grain quality study
0008	Nanette Galang -Gana / Dr. G. Galang Foundation	5 traditional varieties	Seed increase / therapeutic use
0009	Raymond Emmanuel A. Pineda / UP Manila	1 commercial variety	Undergraduate thesis on effects of drought on different developmental stages of NSIC Rc288
0010	Takeshi Kano / Japan International Research Center for Agricultural Sciences (JIRCAS)	3 commercial varieties	Genetic study
0011	Don Dumale / Philippine National Museum	121 traditional varieties	For display / exhibit
TOTAL		**263 varieties**	

Note: with * seeds not from PhilRice Genebank; use of PMTA-GUD was not yet implemented upon received and processing of the seed requests.

Table 7. Monitoring of 2013 IRRI SMTA's and additional IRRI-MTA's for transfer of IRRI germplasm to PhilRice per receipt of seed requests from PhilRice researchers.

2013-GRDO-SMTA-	Additional MTA Attachment	REQUESTED BY/DIVISION	NO. OF VARIETIES OR LINES	PURPOSE OF REQUEST
0001		N. Manigbas / PBBD	2	Common varieties multi-location experiment
0002		M. Rosario / PBBD	10	Research
0003		E. Gergon / PhilRice L.B.	3	Farmer's field trial
0004		L. Gramaje / PBBD	50	2013 HRDC
0005		T. Padolina (PBBD) et. al.	50	2013 HRDC
0006		T. Padolina / PBBD	17	NCT
0007		H. Ticman / PBBD	4	2013 WS techno-demo
0008		T. Sigari / PBBD	160	Screening of IRRI-developed drought lines
0009		T. Padolina / PBBD	4	NCT
0010		L. Perez / GRD	2	Research
0011		W. Barroga / PBBD	1	Seedling vigor study
0012		L. Perez / GRD	1	Research / conservation
0013	IRRI-OMTA	T. Padolina / PBBD	4	GSR on-farm trials (Tarlac)
0014		T.H. Xuan / CPD	10	Blast research
0015	IRRI-CMTA	Vicky Lapitan / PhilRice LB	73	Research
0016		L.M. Perez / PhilRice	2	Research
0017		T.F. Padolina / PhilRice	2	Research
0018		T.F. Padolina / PhilRice	302	2014 DS trial: PRAY SKEP II Panel
0019	IRRI-OMTA	E. Arocena / PhilRice	15	Multi-location (Philippines) evaluation of recombinant inbred lines for identifying most adapted line for varietal promotion
0020	IRRI-OMTA	T.F. Padolina / PhilRice	781	2014 DS MET Trials (PhilRice)
0021	IRRI-OMTA	T.F. Padolina / PhilRice	12	to be used as parental lines
0022	IRRI-CMTA	O. Manangkil / PhilRice	106	materials for the BMZ funded project

Germplasm inventory

MC Ferrer, DA Saclangan, MIC Calayugan, CQ Cortaga, DF Villanueva, JN Castro, JT Marturillas, JMM Vino and LMPerez

Preservation of genetic integrity and prolonging the longevity is the goal of germplasm conservation. However, due to evolving seed processing practices through the years, germplasm stocks are in disparate conditions. Consequently it was observed that a high number of germplasm accessions are under critical seed stocks and low viability status. To improve the seed quality of conserved genetic resources, PhilRice Genebank has prioritized the seed identity verification and viability monitoring of its germplasm collection. A detailed inventory system was then initiated to ensure the germplasm's genetic integrity and has preserved with sufficient viable stocks through the application of standard conservation techniques.

Highlights:

- Stocks of germplasm accessions PRRI000914 to PRRI002999 consisting of 3532 seed packets were extracted from the drying room, medium-term, and long-term storage conditions for inventory. From the 2084 accessions listed in the data base only 1707 accessions were obtained from the storage while 377 were missing. It is possible that these accessions have been misplaced or were not properly tracked by GEMS on its current location in PhilRice Genebank.

- To ensure that the conserved germplasm are still the same as the original collection, seed identity was verified through cross-checking with available seed files and field-planting plans. Comparison with available panicle files between seed lot and corresponding seed file was done to verify the identity of the seed lot. The status of the seed information (i.e. mixture, mismatch, infected, etc.) was also noted.

- Of the 2084 accessions processed for inventory, 1355 are matched with the original seed files indicating correct identity of the germplasm. Others including 286 accessions were mismatch indicating that the conserved seed stocks do not match with the original seed file used as reference identity of the materials. 198 do not have seed files and still need re-authentication while 245 are missing or could be out of place from the specific location indicated in the GEMS database (Figure 4).

- Seed samples from each stock were obtained for germination test and moisture content determination. It was observed that a high number of germplasm are under critical viability status (Figure 5). Out of 1355 accessions tested, 560 (41%) had <80% germination, 768 accessions (52%) showed good viability status with >80% germination, while 560 (41%) showed <80% germination. 99 (7%) accessions were found nonviable (0% germination). Accessions identified with <3% viability were prioritized for embryo rescue while those with 3-80% viability and with less than 100g stock were set for regeneration. 159 accessions do not have viability data and will be set for germination testing.

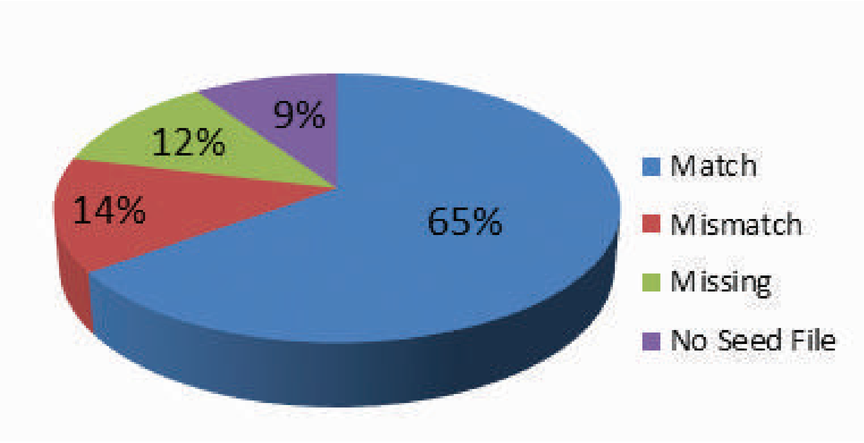

Figure 4. Inventory status of Accessions PRRI000914 to PRRI002999

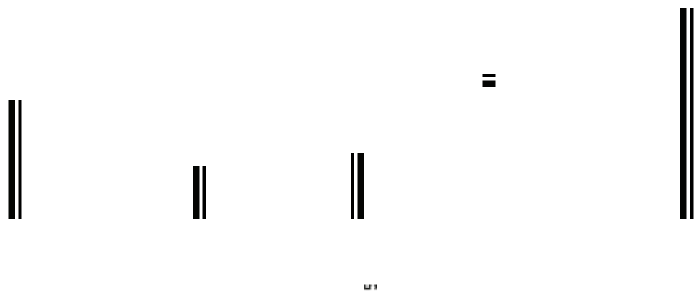

Figure 5. Seed viability status of 1355 verified accessions stored as base and active collections.

Germplasm characterization

MIC Calayugan, MC Ferrer, CL Diaz, and LM Perez

Genetic Resources Division which houses the genebank contains diverse rice germplasm of traditional or indigenous Philippine cultivars and improved varieties. The conserved materials are characterized not only to distinguish different varieties but also to facilitate preliminary selection of germplasm by end-users. The value of the germplasm collection depends upon the availability of information relative to the accessions. Rice germplasm characterization is essential to provide information on the traits of accessions assuring the maximum utilization of the germplasm collection to breeders, researchers, students and interested individuals. The objectives of the study were to characterize rice germplasm materials using standard rice descriptors for efficient selection in breeding programs and ensure availability of phenotypic information needed by researchers, students and other rice stakeholders.

Highlights:

- Fifty-eight quantitative and qualitative agro-morphological traits by Bioversity International (2007) were observed and recorded. These characteristics were identified priority in support for breeding and diversity analysis.

- Total of 1065 entries were characterized in 2013 cropping seasons (Table 8, Figure 6).

- In 2013 dry season, a total of 437 entries were characterized in vegetative stage, 426 in reproductive stage for some varieties were photoperiod sensitive and late maturing and were transferred to screenhouse. Only 423 collections have panicles for posts-harvest characterization.

- In germplasm conservation and management, wet season is considered as ideal season for characterization of germplasm. In 2013WS, total of 628 collections were characterized in vegetative stage, some varieties were photoperiod sensitive, and hence, only 597 were characterized in reproductive stage. Four varieties were late maturing and were transferred to screenhouse. Total of 593 collections have panicle harvests for post-harvest characterization.

- The data obtained were uploaded in the germplasm database to be accessible for researchers to serve as basis for selection of target traits for breeding.

Table 8. Summary of characterized rice germplasm in 2013 dry and wet season

Season	Entries	Vegetative	Reproductive	Post-Harvest
2013DS	437	437 collections	426 collections	423 collections
2013WS	628	628 collections	597 collections	593 collections
Total	1065	1065	1023	1016

Figure 6. Panicle and grain diversity shown by rice germplasm characterized in 2013 cropping seasons.

II. Evaluation of PhilRice Germplasm Collection for Tolerance to Biotic and Abiotic Stresses and Grain Quality

Project Leader: JAB Duldulao (January to June 2013); JN Niones (July to December 2013)

Evaluation of rice germplasm for resistance to diseases and insect pests

JP Rillon, GDC Santiago, and MSV Duca

PhilRice germplasm cultivars need to be continuously screened to determine their resistance to blast, tungro, green leafhoppers and brown planthoppers. Blast and tungro are the most destructive diseases of rice because of their wide distribution and proliferation under favorable conditions. Blast occurs in every growth stages of rice. In severe infections, coalescence of lesion causes dried leaves and whole plants are stunted and killed. If infection occurs at later growth stage, infected panicles become dry and spikelets are almost empty.

Rice tungro causes yellow orange leaf, stunted growth, reduced number of tiller, incomplete panicle insertion with sterile or partially fertile spikelets. Green leafhoppers (GLH) and brown planthoppers (BPH) are insect pests of important concern because they spread viral diseases in the rice fields. Both nymphs and adults infest the rice crop at all stages of plant growth. As a result of feeding at the base of the tillers, the plants turn yellowish and dry up rapidly.

Highlights:

- Two hundred eighty-four (284) PhilRice germplasm accessions were evaluated for resistance to blast, rice tungro virus (RTV), green leafhopper (GLH) and brown planthopper (BPH) under screenhouse condition. Evaluation was done for blast at 30 DAS; RTV at 4 weeks after inoculation; GLH/BPH at 10days after infestation or when the susceptible check is completely killed.

- Out of 284 accessions, 33 were found resistant to blast, 120 had intermediate reactions and 131 were susceptible to the disease (Table 9). IR50 and IR42 were used as susceptible checks in the evaluation of blast resistance while PSB Rc10 was used as resistant check variety. In the case of GLH and BPH, TN1 and TKM6 were used as susceptible and resistant cultivars, respectively. TN1 was also used as susceptible check in tungro evaluation.

- Accession number PRRI001593 (PANDAN) and PRRI002941 (PALAWAN) showed resistant reaction to tungro while accession number PRRI004902 (WAGWAG V4-3), Coll No. 12276 (LAILA 10) and Coll No. 12620 (RED RICE), had intermediate reactions and the rest of the entries were susceptible to the disease.

- 232 accessions showed moderate resistance to BPH and 209 accessions to GLH. The rest of the entries were susceptible to BPH and GLH.

Table 9. Reactions of PhilRice rice germplasm accessions to blast, induced tungro infection, BPH and GLH under screenhouse conditions.

Reaction	No. of Accessions			
	Blast	Tungro	BPH	GLH
Resistant	33	2	0	0
Moderately Resistant	-	-	0	0
Intermediate	120	3	0	0
Moderately Susceptible	-	-	232	209
Susceptible	131	279	52	75

Evaluation of grain quality of traditional varieties conserved at the PhilRice Genebank

JBA Duldulao, KB Bergonio, CT Estonilo, and JD Adriano

PhilRice currently holds about 12,000 rice germplasm collections in which the value of this collections depend on the availability of information. Aside from yield, resistance to pests and diseases, and agro-morphologic qualities, grain quality such as milling recovery, physical attributes and eating properties increases the importance of the germplasm and their potential for eventual utilization by breeders and other stakeholders. In addition, grain quality dictates consumer acceptability and marketability of rice, hence it is considered as an important component in rice breeding program. Evaluation and characterization of PhilRice germplasm collection for grain quality, is therefore, important to its effective utilization and successful conservation.

This study aimed to evaluate the grain quality of the PhilRice germplasm accessions in order to efficiently provide grain quality data through a computerized database system (GEMS).

Highlights:

- Six hundred and nine (609) samples were received and characterized for milling quality (% hull, % brown rice, % milled rice and % head rice), physical attributes (% chalky grains and grain length and shape), and physicochemical properties (moisture content, amylose content, gelatinization temperature by alkali-spreading value, and gel consistency) (Table 10). Three hundred eight t accessions (308) were received during the last quarter of 2012 and two hundred twenty-one (221) additional accessions during the second quarter of 2013.

- Majority of the samples for both batches had good brown rice recovery of at least 85%. About 336 samples from Batch 4 and 181 samples from Batch 5 were identified to have passed the requirement. The same evaluation followed in the milled rice recovery. There were 96% and 94% of the accessions from Batch 4 and 5, respectively, to have passed 65% standard recovery. However, Batch 4 (94%) samples had higher head rice recovery than Batch 5 (58%).

- The preferred dimension for rice grain should be at least long grain length and slender grain shape. About 100 samples from Batch 4 and 58 samples from Batch 5 were categorized to be Extra Long and Long, respectively. Majority of samples from both batches were intermediate in shape. Only 81 samples from Batch 4 and 51 samples from Batch 5 were slender.

- Chalkiness was measured manually by visual inspection. Only 91 from Batch 4 and 78 from Batch 5 accessions had acceptable percentage of chalky grains of less than 5%. Three hundred (300) accessions were identified pigmented and/or glutinous (with opaque endosperm).

- Most of the accessions (407 out of 609) had amylose content of 0-18.0%, which is waxy to low in classification, while 173 and 14 accessions were identified intermediate and high AC type, respectively. As to GT type, most of the entries (509 out of 609) were intermediate to high-intermediate GT type (70°C -74°C GT).

- Out of 609 accessions screened for grain quality this year, we found 38 entries with potential as parentals in a breeding for grain quality program. About 23 samples from Batch 4 and 15 samples from Batch 5 comprised that evaluation. These accessions had superior head rice recovery (grade 1 to premium), chalkiness of less than 5%, long and slender grain dimensions, and apparent soft to intermediate cooked rice texture as indicated by an amylose content of low to intermediate (14.2 to 24.4 % AC), and gelatinization temperature type of low to high intermediate(<74.0°C GT).

Table 10. Grain quality properties of PhilRice germplasm accessions evaluated in 2013

Grain Quality Property		Number of Entries	
Parameter/ Level/ Classification		BATCH 4	BATCH 5 (N=221)
Milling Recovery, Physical Attributes, Physicochemical			
Brown Rice			
>80%	Good	18	31
75.1- 79.9%	Fair	308	150
<75%	Poor	62	41
Milled Rice			
>70.1%	Premium	186	111
65.1- 70.0%	Grade 1	188	96
60.1- 65.0%	Grade 2	12	6
55.5- 60.0%	Grade 3	2	9
<55.5%	Below Standards	-	-
Head Rice			
>57%	Premium	286	64
48.0- 56.9%	Grade 1	78	66
39.0- 47.9%	Grade 2	21	39
30.0- 38.9%	Grade 3	3	35
<30.0%	Below Standards	-	18
Chalkiness			
0.1- 2.0%	Premium	40	30
2.1- 5.0%	Grade 1	51	48
5.1- 10.0%	Grade 2	64	38
10.1- 15.0%	Grade 3	36	18
>15.0%	Below Standards	45	10
Grain Size			
>7.5mm	Extra Long	9	1
6.4- 7.4mm	Long	91	57
5.5- 6.3mm	Medium	232	125
<5.4mm	Short	56	38
Grain Shape			
>3	Slender	81	51
2.0- 3.0	Intermediate	251	138
<2.0	Bold	56	32
Amylose			
0.0- 2.0%	Waxy	37	3
2.1- 10.0%	Very Low	15	15
10.1- 18.0%	Low	191	60
18.1- 25.0%	Intermediate	129	144
>25.0%	High	14	-
Gelatinization Temperature			
74.5-80.0°C	High	15	-
70.0-74.0°C	High Intermediate	144	37
70.0-74.0°C	Intermediate	159	157
<70.0°C	Low	72	25

Evaluation of PhilRice germplasm collections for drought tolerance
JN Niones, MCN Julaton, and RR Suralta

The single line-source sprinkler system (LSS) was conceptualized and introduced to impose and create a continuous variable water application across a research field plot (Hanks et al., 1976; Bauder et al., 1975; Willardson et al., 1987; Hanks et al., 1980). The LSS configuration provides a linearly decreasing irrigation application rate perpendicular to the sprinkler line, thus, it has been utilized to study crop response to variable amounts of irrigations and to different soil moisture intensities. This study aimed to evaluate and screen PhilRice germplasm collections under different intensities of drought stress using the line source sprinkler system. Germplasm collections were transplanted and conducted in the watertight experimental bed with line-source sprinkler system under a rain-out shelter. Each line was planted at 20cm between rows and 45cm between hills in RCBD with two replications. IR64 and KDML 105 served as control genotypes. Fertilizer rate was 240-120-120 kg NPK/ha (DS) and 120-60-60 kg NPK/ha (WS) applied in two splits (basal and maximum tillering stage). Draining of water started at 14DAT after the plants have recovered. Soil moisture sensors were placed at both sides of the seedbed at varying distance from line-source sprinkler (10cm, 40cm, 80cm, 120cm, 160cm), respectively. Re-irrigation was done when the soil moisture at 80cm distance was below 30%VMC. Each entry was finally sampled and terminated 3 weeks after heading. Agronomic data (plant height, number of tillers and biomass) and root data (number of nodal roots (NRN), Total Root Length (TRL), Total Nodal Root Length (TNRL), Total Lateral Root Length (TLRL), and Root Dry Weight (RDW) were gathered.

Highlights:

- In 2013 DS, a total of 22 germplasm were screened and evaluated. Among the germplasm, PRRI001951 (P7-3-1), PRRI004381 (Arabon) and PRRI001034 (Baksalan Kawalwal) consistently showed high shoot biomass at different intensities of progressive drought stress.

- The shoot dry weight of P7-3-1 (39.1-18.0 g plot-1), Arabon (23.6-1.5 g plot-1) and Baksalan Kawalwal (22.1 – 10.g plot-1) at the distance of 30 cm and 170 cm (Figure 7). This may be attributed to high number of tiller per plant.

- IR64, KDML 105, Dugayyong, Mindanao, P7-3-1, P11-6-19 and Binuhangin produced more tillers at a planting distance of 10cm-90cm, which had relatively high soil moisture content.

- The root system development of 3 selected genotypes (P7-3-1, Baksalan Kawalwal and Arabon) demonstrated higher TRL, TNRL and TLRL than IR64 but comparable with that of KDML 105 (Figure 8). IR64 (395 nodal roots plant-1) showed higher count of nodal roots at 30cm compared to KDML 105 (345 nodal roots plant-1). Baksalan Kawalwal and P7-3-1 genotypes exhibited moderate number of nodal roots in response to different intensities of soil moisture (Figure 9).

- In 2013 WS, 26 germplasm materials were evaluated for their responses in different intensities of drought stress. Five genotypes including PRRI001037 (M5), PRRI001038 (M45), PRRI001014 (Binato), PRRI002324 (Binintanag), and PRRI000593 (Belibod) showed good performance as indicated in % decrease in biomass in response to different intensities of soil moisture relative to well-watered hill per genotype at 30cm distance from sprinkler.

- PRRI001856 (Camuros), PRRI003203 (Macaneneng), PRRI001034 (Baksalan Kawalwal showed poor performance in response to different intensities of soil moisture (Figure 10).

- The canopy temperature of all germplasm increased as the plant went farther from the line-source sprinkler except PRRI001829 (Maluit) and PRRI001785 (Kinanda) which showed comparably low canopy temperature from 30cm-170cm. However, PRRI001829 (Maluit) and PRRI001785 (Kinanda) did not show a relatively good biomass production under different soil moisture intensities. Analysis for root system developmental responses is still in progress.

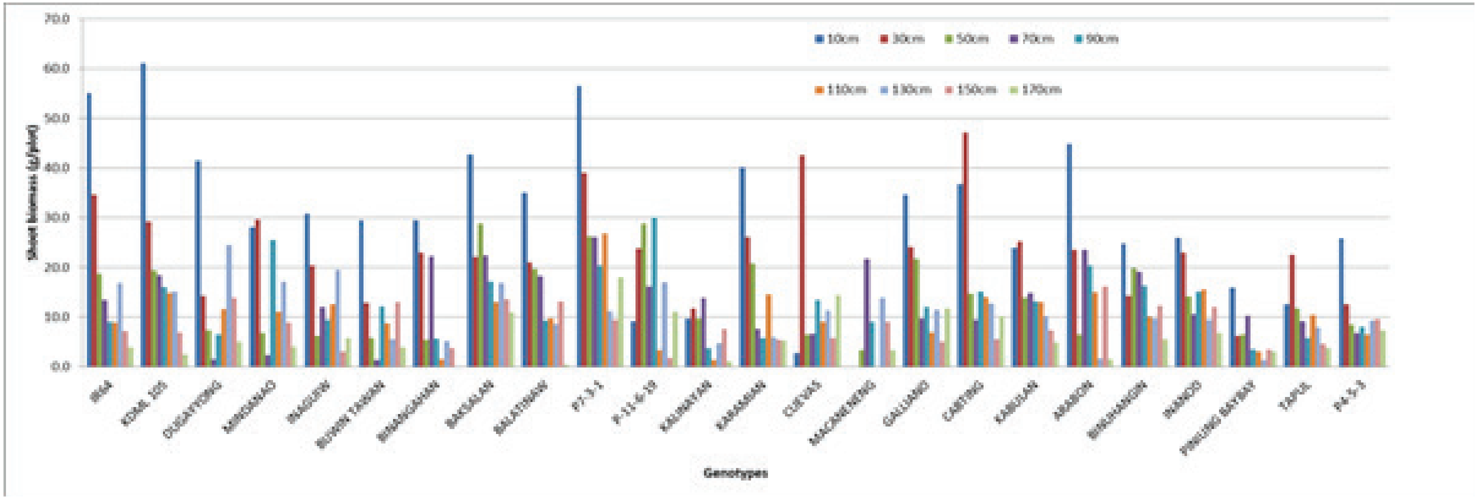

Figure 7. Shoot biomass of 22 germplasm materials evaluated in line source sprinkler system in 2013DS.

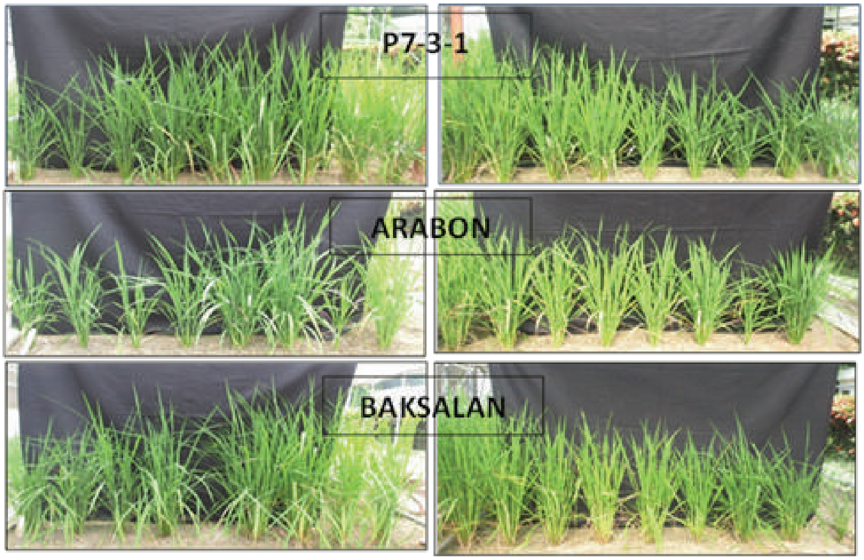

Figure 8. Top three germplasm materials with high shoot growth response at different intensities of progressive drought stress in 2013DS.

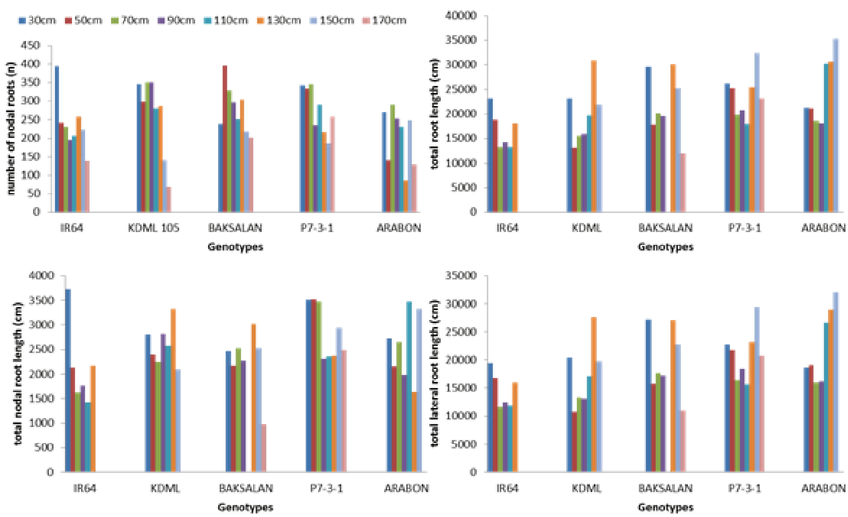

Figure 9. Top three germplasm materials and IR64 (control) total root length and its root component in response to different intensities of progressive drought stress in 2013 DS.

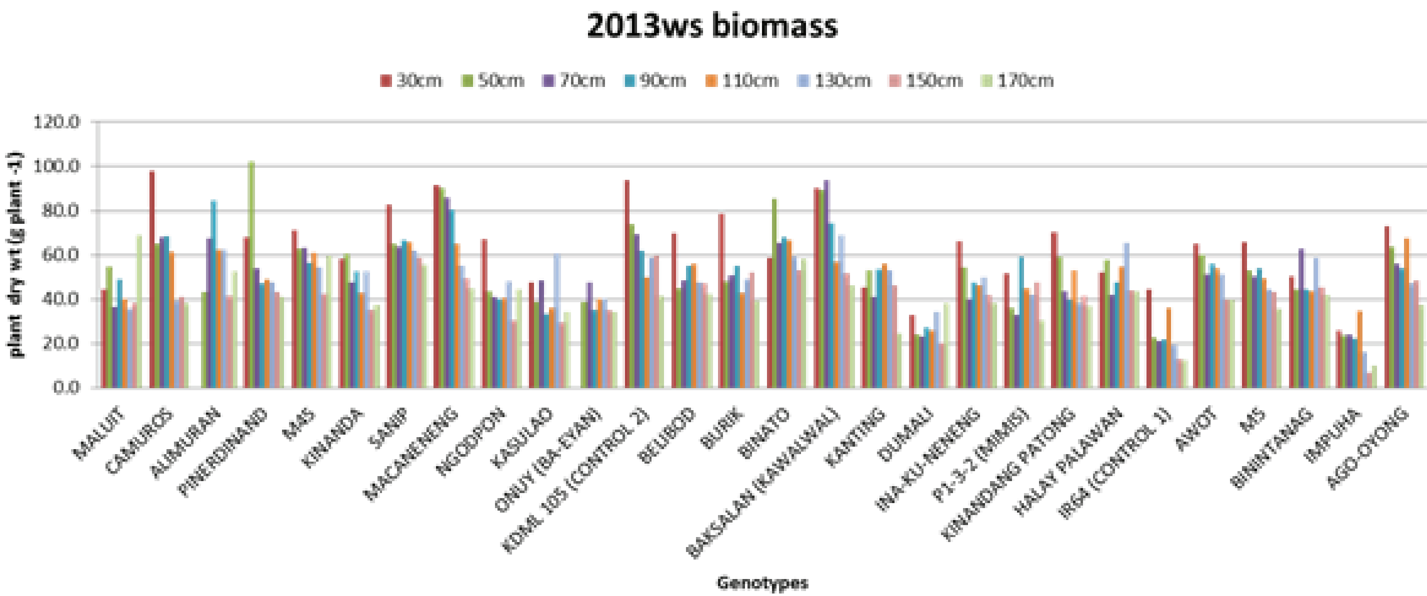

Figure 10. Shoot dry matter production of 26 germplasm materials evaluated at line-source sprinkler system in 2013WS.

III. Genetic Resources Research
Project Leader: LM Perez

MAGIC (Multiparent Advanced Generation Inter Crosses) in PhilRice genetic resources
MIC Calayugan, TE Mananghaya, VG Dalusong, and LM Perez

In the development of rice cultivars adapted to specific environmental conditions, genetic resources are important in providing appropriate parental donors that can be sources of important traits or genes for high yield, resistance to pests and diseases, and grain quality. Numerous studies were conducted exploring favorable alleles using mostly bi-parental mapping populations in genetic and association studies. However, the natural richness of alleles or genetic variations existing in our germplasm has not been exhaustively explored yet to the breeders' advantage. This study explored the method of MAGIC to exhaust natural allelic variants that can be sources of novel quantitative trait loci (QTL) for traits like yield, disease resistance, tolerance to abiotic stresses like drought, submergence, and salinity, as well as grain quality.

MAGIC is an experimental method with which genetic markers are linked to quantitative trait loci (QTL) (IRRI, 2011). It was introduced by Mott et al. (2000) in mice as an extension to the advanced intercross (AIC) procedure of Darvasi and Soller (1995). MAGIC populations are established by several rounds of intercrossing multiple founder lines and the resulting populations are, hence, genetically diverse essential for the detection of multiple QTLs at the same time. As part of the preliminary investigation, the focus was to determine potential founder lines in the PhilRice genetic resources. Decision of founder lines to be included in the MAGIC population was done with the breeders and in consideration with unique agronomic traits suitable to the need of rice farmers in the Philippines. Phenotyping as well as molecular characterization of the founder lines were explored by establishing the traits and methodologies as well as appropriate genetic marker systems for the molecular analysis.

Highlights:

- First crossing cycle with 28 single intercrosses were made using a half diallel mating scheme (Table 11). Total of 21 F1 plants were successfully generated while the rest were not crossed due to non-synchronization of flowering time between the male and female parents. Hybridization will be initiated in 2014DS to complete the half diallel mating scheme involving the 8 founder lines

- Agro morphological data of the 8 founder lines were gathered including 8 quantitative (Table 12) and 30 qualitative traits

(Table 13). Flag leaf and culm length were diverse among the founder lines ranging from 27.6-49.4 cm and 93-127.4 cm, respectively (Table 12). Binignay (PRRI000444) was highest in terms of flag leaf length at 49.4 cm.

- In terms of qualitative morphological traits, 3 out of 8 founder lines were glabrous including Monday (PRRI000426), Tapol white (PRRI000860), and Kalangiking (PRRI000230) while the rest showed intermediate leaf blade pubescence (Table 13).

- Evaluation of the founder lines' reactions to biotic and abiotic stresses showed potential sources of novel gene(s) for bacterial blight, sheath blight and rice tungro disease resistance as well as source of drought tolerance (Table 14).

Table 11. Crossing matrix for MAGIC populations

FEMALE	ENTRY NAME	TRAIT	MALE						
MGC 5	AZUCENA	DROUGHT RESISTANT							
MGC 6	GOBERNO (PUTI)	DROUGHT RESISTANT	**MGC 5**						
MGC 8	BUWA	RICE SHEATH BLIGHT RESISTANT	**MGC 5**	**MGC 6**					
MGC 9	MONDAY	RICE TUNGRO REACTION RESISTANT	**MGC 5**	**MGC 6**	**MGC 8**				
MGC 10	BINIGNAY	RICE TUNGRO REACTION RESISTANT	MGC 5	**MGC 6**	**MGC 8**	MGC 9			
MGC 13	PSB Rc3	Upland	**MGC 5**	**MGC 6**	MGC 8	MGC 9	**MGC 10**		
MGC 14	TAPOL WHITE	RICE TUNGRO REACTION RESISTANT	**MGC 5**	**MGC 6**	**MGC 8**	MGC 9	**MGC 10**	**MGC 13**	
MGC 15	KALANGIKING	RICE SHEATH BLIGHT RESISTANT	**MGC 5**	MGC 6	**MGC 8**	MGC 9	**MGC 10**	**MGC 13**	**MGC 14**

*successful crosses were highlighted

Table 12. Quantitative morphological traits of MAGIC founder lines

Seedlot Number	Accession No.	Variety Name	Maturity	FLAG LEAF LENGTH (cm)	FLAG LEAF WIDTH (cm)	CULM LENGTH (cm)	CULM NUMBER PER PLANT	CULM DIAMETER AT BASAL INTERNODE (mm)	PANICLE NUMBER PER PLANT	PANICLE LENGTH OF THE MAIN AXIS (cm)
MGC-5	PRRI005942	AZUCENA	98	31	1.9	126.6	11	7	11	33.58
MGC-6	PRRI006023	GOBERNO (PUTI)	106	29.8	2.32	127.4	11.6	9.4	11.6	32.94
MGC-8	PRRI000378	BUWA	124	31.6	1.72	98.8	7	5.4	7	23.725
MGC-9	PRRI000426	MONDAY	107	27	1.675	93	6.5	4.5	6.5	23.54
MGC-10	PRRI000444	BINIGNAY	125	49.4	2.12	106	10.6	8.4	10.6	29.3
MGC-13	PRRI001191	PSB Rc3		33.8	1.9	98.6	20.8	6.6	20.8	28.4
MGC-14	PRRI000860	TAPOL WHITE	124	27.6	2.08	107.6	12.2	6.4	12.2	22.5
MGC-15	PRRI000230	KALANGIKING	118	30.2	1.9	112	10.2	8.4	10.2	28.68

Table 13. Qualitative morphological traits of MAGIC founder lines

Seedlot Identity	Accession No.	Variety Name	BASAL LEAF SHEATH COLOR	LEAF SHEATH ANTHOCYANIN COLORATION	LEAF BLADE ANTHOCYANIN COLORATION	LEAF BLADE DISTRIBUTION OF ANTHOCYANIN	LEAF BLADE INTENSITY OF GREEN COLOR	LEAF BLADE ATTITUDE	LEAF BLADE PUBESCENCE	AURICLE COLOR	COLLAR COLOR	LIGULE SHAPE
MGC-5	PRRI005942	AZUCENA	green	absent	absent	absent	medium	erect	intermediate	yellow green	light green	2-CLEFT
MGC-6	PRRI006023	GOBERNO (PUTI)	green	absent	absent	absent	medium	erect	intermediate	yellow green	light green	2-CLEFT
MGC-8	PRRI000378	BUWA	green	absent	absent	absent	medium	erect	intermediate	yellow green	light green	2-CLEFT
MGC-9	PRRI000426	MONDAY	green	absent	absent	absent	medium	erect	glabrous	yellow green	light green	2-CLEFT
MGC-10	PRRI000444	BINIGNAY	green	absent	absent	absent	medium	erect	intermediate	yellow green	light green	2-CLEFT
MGC-13	PRRI001191	PSB Rc3	light purple	medium	present	margins only	medium	erect	intermediate	yellow green	purple lines	2-CLEFT
MGC-14	PRRI000860	TAPOL WHITE	Green/purple lines	weak	present	blotches only	Dark	erect	glabrous	purple lines	purple lines	2-CLEFT
MGC-15	PRRI000230	KALANGIKING	green	absent	absent	absent	medium	erect	glabrous	yellow green	light green	2-CLEFT

Seedlot Identity	Accession No.	Variety Name	LIGULE COLOR	FLAG LEAF ATTITUDE OF BLADE EARLY OBSERVATION	CULM HABIT (ANGLE)	CULM KNEEING ABILITY	CULM ANTHOCYANIN COLORATION OF NODES	CULM UNDERLYING NODE COLOR	CULM INTERNODE ANTHOCYANIN	CULM UNDERLYING INTERNODE COLORATION	FLAG LEAF ATTITUDE OF BLADE LATE OBSERVATION	LEMMA AND PALEA COLOR EARLY OBSERVATION
MGC-5	PRRI005942	AZUCENA	white	erect	erect	absent	Absent	light gold	absent	light gold	descending	green
MGC-6	PRRI006023	GOBERNO (PUTI)	white	erect	erect	absent	Absent	green	absent	green	horizontal	green-stripped white
MGC-8	PRRI000378	BUWA	white	erect	erect	absent	Absent	green	absent	green	semi-erect	purple spots on green
MGC-9	PRRI000426	MONDAY	white	erect	erect	absent	Absent	green	absent	light gold	semi-erect	green
MGC-10	PRRI000444	BINIGNAY	white	erect	erect	absent	Absent	light gold	absent	light gold	semi-erect	green
MGC-13	PRRI001191	PSB Rc3	white	erect	erect	absent	Absent	green	absent	light gold	horizontal	green
MGC-14	PRRI000860	TAPOL WHITE	purple lines	erect	erect	absent	purple lines	green	purple lines	green	semi-erect	yellowish green
MGC-15	PRRI000230	KALANGIKING	white	semi-erect	erect	absent	Absent	green	absent	light gold	semi-erect	gold and gold furrows

Seedlot Identity	Accession No.	Variety Name	LEMMA COLOR OF APICULUS EARLY OBSERVATION	AWNS DISTRIBUTION	AWN COLOR EARLY OBSERVATION	PANICLE MAIN AXIS ATTITUDE	PANICLE ATTITUDE OF BRANCHES	PANICLE SECONDARY BRANCHING	PANICLE EXSERTION	CULM LODGING RESISTANCE	LEAF SENESCENCE	PANICLE SHATTERING
MGC-5	PRRI005942	AZUCENA	straw	upper quarter only	straw	strongly drooping	semi-compact	dense	well exserted	intermediate	late	moderate
MGC-6	PRRI006023	GOBERNO (PUTI)	straw	absent	absent	semi-upright	Open	sparse	moderately well exserted	intermediate	late	high
MGC-8	PRRI000378	BUWA	purple apex	absent	absent	semi-upright	semi-compact	dense	well exserted	strong	intermediate	moderate
MGC-9	PRRI000426	MONDAY	purple apex	absent	absent	semi-upright	Open	sparse	well exserted	strong	late	moderate
MGC-10	PRRI000444	BINIGNAY	purple apex	absent	absent	slightly drooping	semi-compact	dense	well exserted	strong	very late	high
MGC-13	PRRI001191	PSB Rc3	red	absent	absent	slightly drooping	semi-compact	dense	moderately well exserted	strong	late	high
MGC-14	PRRI000860	TAPOL WHITE	purple	absent	absent	strongly drooping	semi-compact	dense	moderately well exserted	strong	intermediate	high
MGC-15	PRRI000230	KALANGIKING	green	absent	absent	slightly drooping	semi-compact	dense	just exserted	strong	intermediate	moderate

Table 14. Selected Philippine traditional rice varieties from PhilRice Genebank used as founder lines for the development of MAGIC population.

SSION O.	COLLECTION NUMBER	CULTIVAR NAME	PROVINCE	PREFERRED GROWING CONDITION/ ECOSYSTEM	MATURITY (DAS)	CULM STRENGTH	BACTERIAL LEAF BLIGHT	RICE SHEATH BLIGHT	RICE TUNGRO REACTION (INDUCED)	DROUGHT SENSITIVITY	PRODUCTIVITY
05942	11145	AZUCENA	Kalinga		98					Resistant	5 - Intermediate (~15 panicles)
06023	11152	GOBERNO (PUTI)	Kalinga		106					Resistant	5 - Intermediate (~15 panicles)
00378	2361	BUWA	Kalinga-Apayao	2 - Rainfed Lowland	124			R - 1 - 0-30% infection			
00426	2409	MONDAY	Palawan (West)	1 - Upland	107		R - 1 - 0-5% lesion area	R - 1 - 0-30% infection	R - 0-20% infected		5 - Intermediate (~15 panicles)
00444	2427	BINIGNAY	Occidental Mindoro	2 - Rainfed Lowland	125			R - 1 - 0-30% infection	R - 0-20% infected		5 - Intermediate (~15 panicles)
00230	2213	KALANGIKING (KILING)	Pangasinan	2 - Rainfed Lowland	118	5 - Intermediate (most plants leaning about 45°)		R - 1 - 0-30% infection			5 - Intermediate (~15 panicles)
00860	1131	TAPOL WHITE	Cotabato		124				R - 0-25% infected		
01191	2593	PSB Rc3		1 - Upland							

Comparison of microsatellite DNA fingerprints of original seed files and conserved germplasm accessions

CQ Cortaga, VG Dalusong, and LM Perez

The morphological and molecular identity of genebank accessions is vital to the effective management, conservation and utilization of germplasm resources of any research institution. In the normal genebank operations, accessions are acquired and processed through following standard operating procedures that included the preparation of original seed files. The seed file serves as resource for verification of conserved germplasm accessions. Therefore, seed files play a very important role in a genebank and thus ensuring their correct identity indicates efficiency in germplasm conservation. DNA markers are being applied to a wide variety of problems central to plant genome analysis. These markers reflect genetic polymorphism at the DNA level, which result from any possible differences existing in the nucleotides (Xu, 2003). With the advent of Plant Variety Protection Act 2002 (Republic Act No. 9168) (PhilRice, 2004), it has become apparent that conventional phenotypic means will not suffice to determine the exact identity of a particular cultivar. In soybean [Glycine max (L.) Merr.], DNA fingerprinting using SSR markers has provided an excellent complement to the conventional markers used to characterize soybean genotypes (Rongwen et al., 1995). In rice, Yashitola et al. (2002) suggested that a single, appropriately chosen SSR marker is sufficient to assess hybrid seed purity in the F1 hybrid and parental lines.

This study focused on comparing the DNA fingerprints of the original seed files and the conserved germplasm accessions located in both active and base collections. In the recent seed preparation for the regeneration and characterization of germplasm in 2012 DS, several seed packets exhibited mismatched with the supposedly original seed files. Although these accessions were not included for 2012DS, the probability of obtaining the same scenario in the future remains. Therefore, there is a need to establish the similarity of the seed files and those conserved in the active collections.

Highlights:

- Twenty-three microsatellite markers were used in the comparison of DNA fingerprints generated in seed files of 96 germplasm accessions with their corresponding seed stocks in cold storage. The accessions studied were randomly identified covering 50% (48) obtained from pre – 2008 stocks (collections before 2008) and 50% from post – 2008 stocks (collections from 2008 up to the present).

- DNA fingerprinting comparison indicated that 33 entries showed 100% similarity in DNA profile (seed file and corresponding stocks in storage) using the 23 markers. The results also indicated that the seed files of 15 entries showed DNA fingerprints not completely the same (less than 100% similar) with their corresponding seed stocks conserved.

- Among the 96 accessions evaluated, Dagi (PRRI002536, sample no. 9) exhibited the highest number of markers that generated different bands between its seed file and active collection in the 48 pre-2008 entries (Figure 11).

- Detection of allele similarities and allele scoring of bands are currently being conducted on the remaining 48 accessions. Genetic similarity using the NTSYS-pc software will be carried out after obtaining complete DNA amplification from both seed files and active collection of the germplasm accessions in the study. Confidence limits of the genetic similarity values will be conducted using Bootstrap analysis.

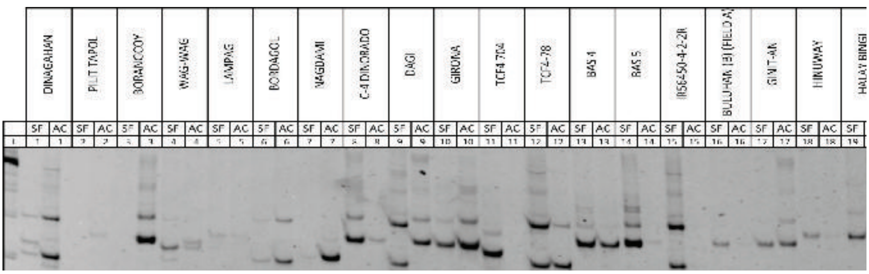

Figure 11. A gel picture showing band profile of seed file (SF) and active collection (AC) samples placed side by side showing alleles generated by microsatellite marker RM547.

IV. Germplasm collection and evaluation in the branch stations

Project Leader: LM Perez

Germplasm collection and evaluation in PhilRice Batac

AY Alibuyog, JM Solero, NI Martin, GB Agustin, and BM Catudan

Farmers opt to plant traditional varieties for various reasons: adaptability, resistance to extreme climatic conditions, and tolerance to pests, minimal external input requirements, excellent grain and eating quality, among others. A variety that has been grown for a long period in a particular area eventually adapts to biotic and abiotic stresses. The fact that farmers continue to raise them is an indication that the varieties thrive well in the area. In a high-risk production environment, farmers tend to minimize their production cost exposure and practice low-input farming. The ability of a variety to provide adequate yield even with minimal or virtually no supplemental application of fertilizers, reinforced its sustained use by farmers who grow it in marginal areas including acidic soils, saline-prone, flooded or upland. Most traditional varieties that remained popular among farmers are those with excellent grain and eating qualities. Lots of farmers take pride in consuming rice with outstanding eating qualities. They reason out that eating high-quality rice compensates for a simple and limited viand.

It is a common practice that farmers grow traditional varieties and use the harvested seeds as planting materials without being conscious in the selection and absence of systematic purification process. This resulted to variety mixture and loss of seed vitality. The most serious problem is when seeds of a variety are totally wiped out in a locality. Some farmers in Ilocos Norte have reported that they could no longer plant certain traditional varieties that they had been growing for a long time because their last standing crop was completely destroyed by natural calamities. Unless a move is done to help conserve these traditional rice varieties, they may soon be completely obliterated from the agro-ecosystem. These traditional varieties that remained in the rice production map may also have genetic characteristics that can overcome environmental stresses. It is possible that a submergence-tolerant variety can likewise perform excellently in saline prone fields. This implies that breeders can have genetic materials to develop new varieties that possess multiple tolerances to abiotic stresses.

Highlights:

- In 2013 WS, 39 TRVs and a modern upland rice variety, NSIC Rc9 (as check) were evaluated for yield and yield component traits. The TRVs were the highest yielders from the variety characterization in 2012WS conducted in earlier studies (BYB-002-002).

- The entries were laid out in Randomized Complete Block Design (RCBD) with three replications. Each plot measured 3m x 4m, one meter apart between blocks and replications. Agronomic parameters including plant height, number of tillers/hill, days to flowering and days to maturity from the day of seed emergence, yield and yield components were gathered.

- Table 15 shows that 27 of the 37 TRVs had comparable yield with NSIC Rc9 while the rest had significantly lower yield. The high yield of Balsamo A (4112 kg/ha) was attributed to its intermediate number of productive tillers (11 tillers/hill) and high number of filled grains (228 grains/panicle). In terms of tillering ability, NSIC Rc9 outperformed all the TRVs with 16 tillers/hill but comparable to Langpadan which produced 15 tillers/hill. Interestingly, the 2 cultivars had comparable panicle length which is shorter than the rest of the TRVs evaluated which showed 25.4cm to 36.8cm in length. On the other hand, five TRVs had more filled grains than the check including Banglo (285 grains), Dinorado (246 grains), Balsamo A (228 grains), Gobyerno A (210 grains), Balsamo B (207 grains). The rest of the TRVS had filled grains comparable with the check. Ballatinaw (Mt. Province) had the densest seeds (40 g/1000 seeds) while NSIC Rc9 weighed only 22 g. Ten of the TRVs had comparable seed weight with the check while the rest of the entries had significantly denser seeds.

- Field evaluation by farmers was conducted on October 18, 2013 before crop harvest to select the best varieties based on the entry’s overall crop stand. The participatory evaluation was attended by 30 upland farmers from Currimao, Ilocos Norte. Results showed that the most preferred varieties were Dinorado, Isic Pugot and Balsamo B (Table 16). These three entries had comparable yields with NSIC Rc9. During the field- day, farmer-participants indicated their interest to try the TRVs particularly those chosen during the participatory evaluation

- PhilRice Batac was able to collect 165 TRVs from 2011 to 2013 (Table 17). Majority of the TRVs were procured from upland areas, the remaining from saline, submerged and highland irrigated areas. Sample seeds of the TRVs are being stored in an air-conditioned room at PhilRice Batac. Sample seeds of 63 TRVs in 20 g pack were sent to the genebank of PhilRice Central Experiment Station for safekeeping.

Table 15. Yield and yield component traits of traditional rice varieties evaluated under upland ecosystem in Comcomloong, Currimao, Ilocos Norte during 2013WS.

Entry Number	Entry Code	Entry Name	Yield (kg/ha)	Tiller Count	Panicle Length (cm)	Number of Filled Grains	Seeds Weight (g/1000 seeds)
Check	TRV40	NSIC Rc9	3437	16	22.0	154	22
1	TRV1	Isic Pugot	3126^{ns}	7$^{\#}$	25.4*	186^{ns}	28*
2	TRV2	Sinelat	3269^{ns}	10$^{\#}$	31.7*	130^{ns}	34*
3	TRV3	Balsamo A	4112^{ns}	11$^{\#}$	28.8*	228*	25^{ns}
4	TRV4	Minama	2561^{ns}	10$^{\#}$	27.9*	119^{ns}	36*
5	TRV5	Maliket A	2385^{ns}	9$^{\#}$	27.8*	139^{ns}	36*
6	TRV6	Dagmuy	2034$^{\#}$	9$^{\#}$	32.1*	136^{ns}	32*
7	TRV7	Unig	3167^{ns}	8$^{\#}$	31.4*	177^{ns}	24^{ns}
8	TRV8	Ballatinaw (Luna)	1363$^{\#}$	9$^{\#}$	26.2*	111^{ns}	28*
9	TRV9	Gobyerno A	2728^{ns}	8$^{\#}$	32.2*	210*	26^{ns}
10	TRV10	Aringay	3192^{ns}	8$^{\#}$	32.0*	176^{ns}	29*
11	TRV11	Azucena	3037^{ns}	9$^{\#}$	28.4*	177^{ns}	27*
12	TRV12	Azucena (V1)	3007^{ns}	9$^{\#}$	31.2*	201 ^{ns}	28*
13	TRV13	Burgis	2737^{ns}	10$^{\#}$	30.4*	130^{ns}	30*
14	TRV14	Fancy Rice	2403^{ns}	7$^{\#}$	31.8*	188^{ns}	27*
15	TRV15	Gobyerno B	2459^{ns}	8$^{\#}$	32.1*	187^{ns}	28*
16	TRV16	Oskil	2444^{ns}	9$^{\#}$	31.7*	169^{ns}	29*
17	TRV17	Pamplona	3449^{ns}	7$^{\#}$	29.1*	156^{ns}	30*
18	TRV18	Parina	2353^{ns}	11$^{\#}$	24.9*	141^{ns}	34*
19	TRV19	Saba	2041$^{\#}$	7$^{\#}$	27.9*	157^{ns}	30*
20	TRV20	Awan Sapulemon B	2873^{ns}	8$^{\#}$	30.9*	197^{ns}	30*
21	TRV21	Lukdit ni Abalayan	2949^{ns}	9$^{\#}$	27.8*	182^{ns}	31*
22	TRV22	Buga	3342^{ns}	10$^{\#}$	27.8*	161^{ns}	34*
23	TRV23	Madalia	2081$^{\#}$	10$^{\#}$	28.1*	134^{ns}	36*
24	TRV24	Banglo	2139$^{\#}$	9$^{\#}$	29.5*	285*	21^{ns}
25	TRV25	Bulilising	3084^{ns}	11$^{\#}$	28.5*	138^{ns}	34*
26	TRV26	Langpadan	2944^{ns}	15^{ns}	23.7^{ns}	87^{ns}	26^{ns}
27	TRV27	Ballatinaw	2599^{ns}	9$^{\#}$	32.7*	146^{ns}	39*
28	TRV28	Ballatinaw (Dati)	1312$^{\#}$	8$^{\#}$	36.8*	150^{ns}	20^{ns}
29	TRV29	Arimuram	2361$^{\#}$	10$^{\#}$	32.3*	149^{ns}	26^{ns}
30	TRV30	Rafinan	3600^{ns}	9$^{\#}$	28.5*	201^{ns}	29*
31	TRV31	Dinorado	2614^{ns}	9$^{\#}$	27.3*	246*	26^{ns}
32	TRV32	Ballatinaw (Mt. Province)	2153$^{\#}$	9$^{\#}$	32.8*	117^{ns}	40*
33	TRV33	Balsamo B	3437^{ns}	8$^{\#}$	24.0*	207*	30*
34	TRV34	Tagaling	1811$^{\#}$	7$^{\#}$	31.9*	152^{ns}	28*
35	TRV35	Ilonggot	2738^{ns}	12$^{\#}$	27.4*	153^{ns}	20^{ns}

Table 16. The top three most preferred TRVs based from the participatory evaluation in Comcomloong, Currimao, Ilocos Norte.

Top 3 TRVs	Desired Characteristics
Dinorado	Long panicle, translucent grains, compact grains, high no. of filled grains
Isic Pugot	Compact grains, high no. of filled grains, disease resistant
Balsamo B	Good tillering ability, long panicles, big and bold grains, high no. of filled grains, early maturing

Table 17. Summary of germplasm collections of PhilRice Batac from different rice environments during the period 2010-2013.

Province	Upland	Submerged	Saline + Submerged	Elevated-Irrigated
Abra	9			1
Apayao	57			
IlocosNorte	47	2		
Ilocos Sur	16	3		4
Mt. Province	5			14
Benguet				1
Cagayan			4	
Agusan	2			
Total	136	5	4	20

Conservation and evaluation of traditional rice varieties in Northeast Luzon

ATIO Rebong, MA Baliuag, DC Barwelo

Northeast Luzon (NE) has a vast collection of rice germplasm containing a diverse source of important and desirable traits. Evaluation of collected traditional varieties from Region 2 and CAR for abiotic stress tolerance and incorporating them in our rice breeding efforts would greatly benefit our rice farmers.

Highlights:

- In 2013 DS, crop establishment and trait evaluation for tolerance to drought stress was conducted in the screenhouse due to unavailability of on- farm site and due to the small amount of seeds that germinated. A total of 248 germplasm from Region 2 and CAR, including 60 traditional varieties from PhilRice Batac, were sown (direct seeding) for drought evaluation. Around 62% of the materials showed good germination rate including 95 from PhilRice San Mateo collections and 60 from PhilRice Batac.

- Results of drought screening showed 62 of the 95 traditional varieties from Region 2 & CAR were drought tolerant during the 55, 85 and 104 DAS. Eleven were drought sensitive at 85 DAS while 22 and 8 were drought sensitive during 104 DAS and from 85 to 104 DAS, respectively (Table 18).

- Of the materials evaluated from PhilRice Batac, 52 showed drought tolerance during the 3 crop stages while 8 were sensitive to drought during the vegetative and mature stage (Table 19).

- Conservation of new germplasm collections was done by collecting the panicles and seeds, and these were processed for storage. Total of 37 varieties were collected through UpTech's travels to different CAR provinces. Samples included 9 from Bacun, Benguet, 12 from Itogon, Benguet, 6 from Pasil, Kalinga, and 10 from Kibungan, Benguet (Table 20).

- 12 TRV's from Benguet were planted for drought tolerance screening under rainfed conditions in 2013WS. However, due to frequent rainfall, screening of the materials for drought tolerance was not carried out. But the plants were characterized and data are currently being encoded in the database. Seeds harvested were cleaned, properly labelled and stored in sealed drums.

- Initial draft of the germplasm catalog containing 39 traditional varieties with photos and agro morphorphological characteristics was done in Microsoft publisher ready for printing. Additional 20 germplasm collections were also added to the catalog. Draft copy has been saved in CD-RW for submission to project leader (Figure 12).

Table 18. Traditional rice varieties collected from CAR and Region 2 with observable drought sensitivity score of 7-9 (susceptible) during the reproductive (85DAS) and mature phase (104DAS).

No.	TRV's from PhilRice Isabela	Vagetative (55DAS)	Reproductive (85DAS)	Maturity (104DAS)
1	PURIKET	0	5	9
2	SIDINGAN	0	9	9
3	PALAWAN	0	0	7
4	KUTUBE-N	0	0	9
5	MUDUN	0	9	9
6	PARAY KARDANAL	0	0	7
7	GARET	0	7	0
8	MAGETELENG	0	7	0
9	GUYOD	0	0	9
10	PINO	0	9	9
11	DINANNAY DAYKAT	0	0	7
12	ARINGAY	0	9	9
13	APO	0	9	0
14	APSAL	0	7	9
15	MARATANG TANG	0	0	9
16	DIKET	0	0	9
17	DAPPOG (RED)	0	0	9
18	MALAGKIT	0	0	9
19	BUWA	0	0	9
20	EMMANG	0	0	9
21	BESBESYAG	0	0	9
22	CHAYONG	0	0	9
23	C-4 1	0	5	9
24	CAMURUS	0	5	9
25	MINOMAN	0	0	7

Table 19. Traditional varieties from PhilRice Batac showing drought sensitivity during the 2013DS.

No.	TRV's from PhilRice Batac	Vagetative (55DAS)	Reproductive (85DAS)	Maturity (104DAS)
1	Waray	0	7	9
2	Oskil	0	7	9
3	Unig	0	7	9
4	Tagaling	0	7	9
5	Sinelat	0	7	9
6	Sabadilla	0	7	9
7	Saba	0	7	9
8	Pipinta	0	9	9

Table 20. Collected traditional rice seeds from provinces in CAR.

9 Identified & Acquired TRVs in Bakun, Benguet	12 Identified & Acquired TRVs in Itogon, Benguet	6 Identified & Acquired TRVs in Pasil, Kalinga	10 Identified & Acquired TRVs in Kibungan, Benguet
1. Balatinao	1. Saba	1. Chong-ak	1. Kalipago
2. Kandiling	2. Balatinaw	2. Oltan	2. Balatinaw
3. Dikalot	3. Bongkitan Red Rice	3. Urtan	3. Kiangan (Red Rice)
4. Balisanga	4. Shatakan Talon	4. Bayako	4. Balisanga (Poblacion)
5. Oakland	5. Kolong	5. Bayudang	5. Balasinga (Palina)
6. Brando	6. Relip Talon bayag	6. Longa	6. Bongkitan (Glutinous Rice)
7. Kalipago	7. Kaniling		7. Balatinaw (Tacadang)
8. Kalinga	8. Mongay		8. Kabol
9. Waray	9. Malatikan		9. Lasbacan (Red rice)
	10. Bongkitan		10. Lino
	11. Borek Talon bayag		
	12. Bongkitan White		

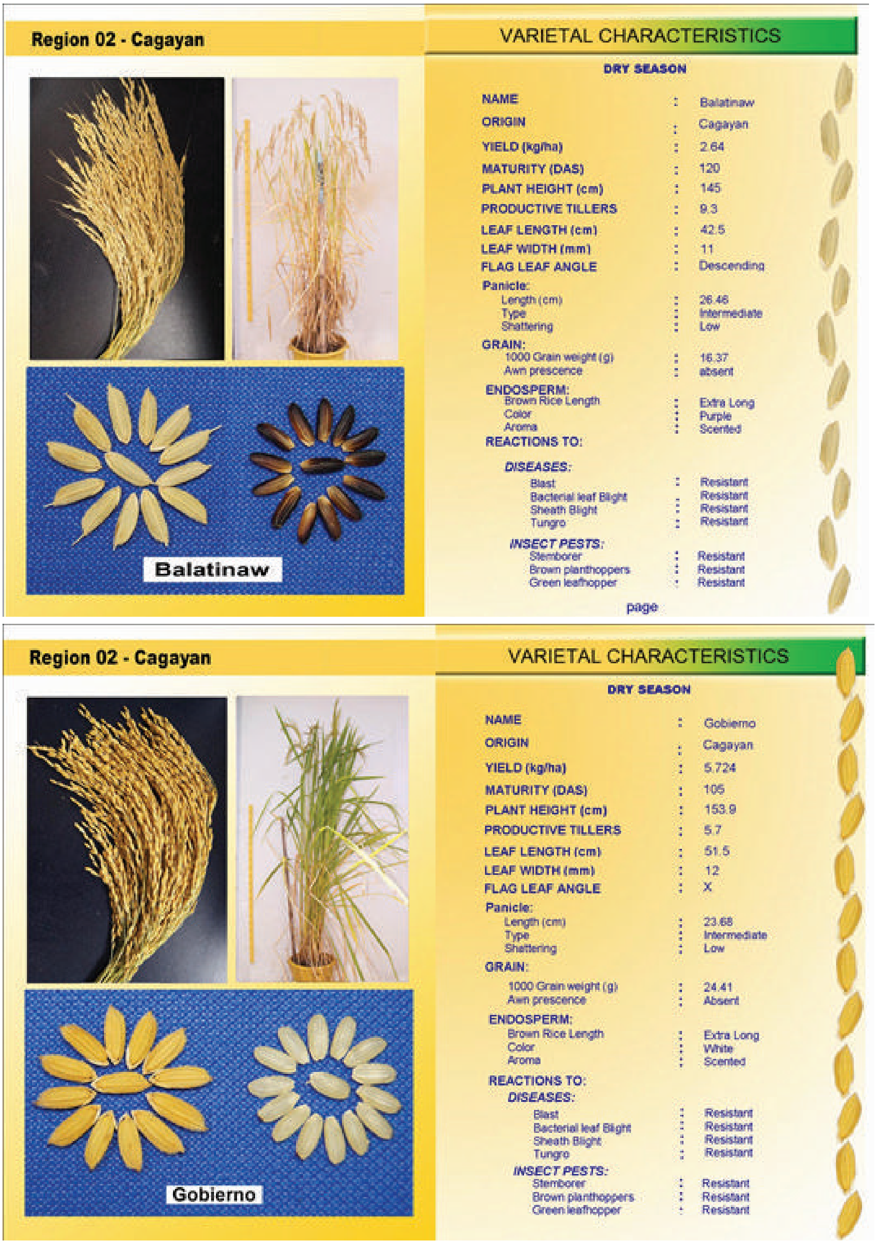

Figure 12. Samples of the catalog draft from the 39 traditional varieties done in Microsoft publisher program.

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 – cystoplasmic 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
$mtha^{-1}$ - 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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Department of Agriculture

PHILRICE

PHILIPPINE RICE RESEARCH INSTITUTE

We are a chartered government corporate entity under the Department of Agriculture. We were created through Executive Order 1061 on 5 November 1985 (as amended) to help develop high-yielding, cost-reducing, and environment-friendly technologoies so farmers can produce enough rice for all Filipinos.

We accomplish this mission through research and development work in our central and seven branch stations, coordinating with a network that comprises 57 agencies and 70 seed centers strategically located nationwide.

To help farmers achieve holistic development, we will pursue the following goals in 2010-2020: attaining and sustaining rice self-suffiency; reducing poverty and malnutrition; and achieving competitiveness through agricultural science and technology.

We have the following certifications: ISO 9001:2008 (Quality Management), ISO 14001:2004 (Environment Management), and OHSAS 18001:2007 (Occupational Health and Safety Assessment Series).

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