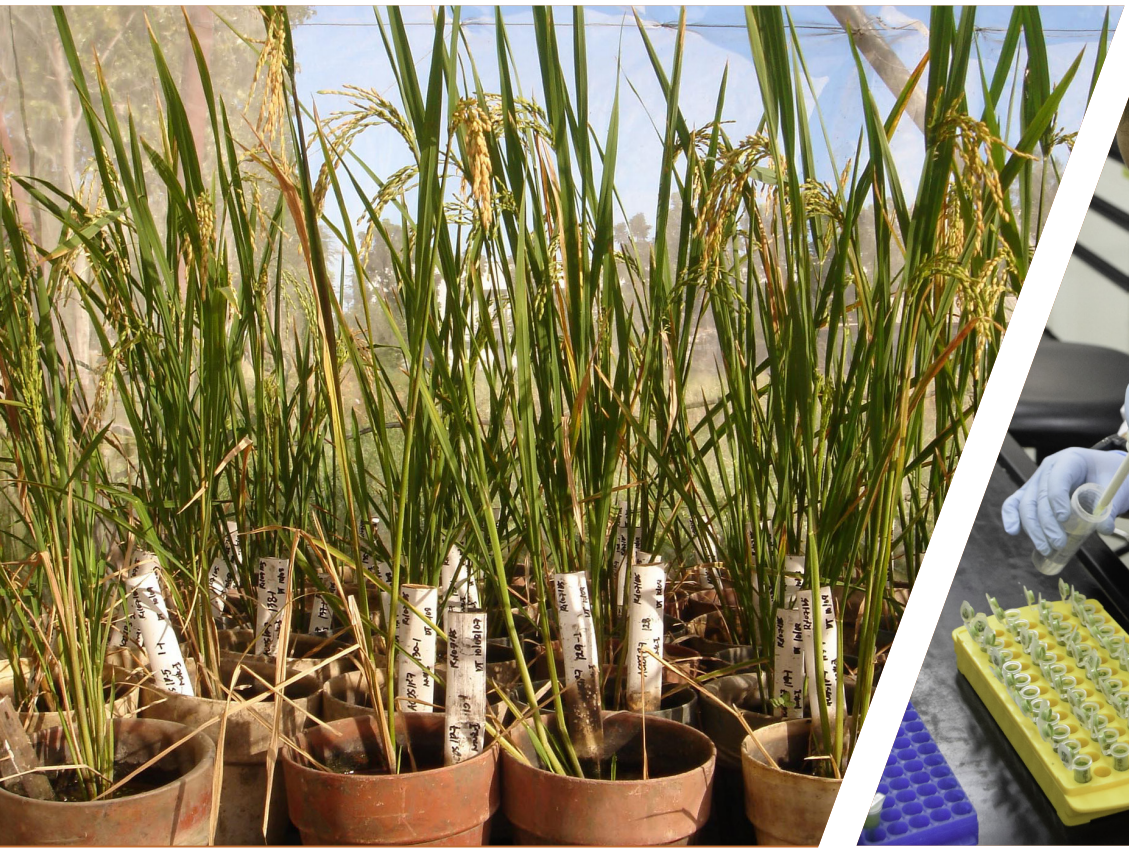
2023 PhilRice R&D Highlights



PLANT BREEDING AND BIOTECHNOLOGY DIVISION

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Plant Breeding and Biotechnology Division

Oliver E. Manangkil

EXECUTIVE SUMMARY

The Division develops promising/elite lines to be entered in the National Cooperative Tests (NCT) for different agro-ecosystems through conventional and modern technologies. Two of the four core projects of PBBD focus on the development of promising lines by incorporating desirable traits to selected elite lines and modern varieties for higher yield, better grain quality, and resilience to major abiotic and biotic stresses. The two other core projects support mainstream breeding through the discovery of new or novel genetics (assembled in centralized nurseries). This is essential in rice breeding for inbred and hybrid as it generates populations for the selection of superior genotypes and widens genetic variability in the gene pool. The centralized nurseries provide breeding materials for all breeding projects including one extra core and two external projects. Two projects financed by the Rice Competitiveness Enhancement Fund are an integral part of varietal development; the extra core and two externally funded projects complement and contribute to the breeding thrusts of the division.

PBD-231: Centralization for Efficient Breeding System

Frodie P. Waing

A diverse collection of 446 entries (234 in DS and 212 in WS), consisting of varieties, elite lines, and accessions from several breeding projects, was assembled in the hybridization block (HB) panel. These entries were grouped into five clusters based on genetic diversity and population structure. Based on analysis through the 1K-RiCA SNP genotyping platform and QTL profiles using a trait-specific SNP base, the genetic diversity of 234 entries is relatively low with pairwise coefficients ranging from 9.7% to 50% (average 38.7%). Also, it was verified that the optimal number of subpopulations was k=5 and assigned each genotype into their respective groups. This was probably due to the use of common parental lines in any breeding program regardless of the environment or breeding objectives.

F2 populations were established in the field nursery and RGA screenhouse facility. Various breeding projects assembled 127 populations (62 DS and 65 WS). Plants were selected and harvested for generation advancement and further evaluation.

PBD-232: Pre-Breeding in Support of Breeding System

Christopher C. Cabusora/Imeldalyn G. Pacada

From the mutated modern varieties, four mutant lines were selected for their maturity ranging from 103 to 113 days and yields of 5041-6887kg/ha. From the mutants derived from NSIC Rc240, a high-yielding dense variety, and lines with 100-104 days maturity were also identified for validation.

In developing new sterile cytoplasm, some plants that expressed seed setting during BC14 F1 were evaluated during BC15 F1 and BC16 F1 generations. This approach was explored to increase F1 progenies having cytoplasmic sterile genes with nuclear recessive genes (S, rf). Highest number of plants evaluated to have pollen classification of unstainend and lightly stained were identified. However, selfing or seed set was observed in the evaluated ratoon plants. This observation will be further investigated by planting the produced PC to generate conclusion in terms of pollen stability and spikelet fertility/sterility expression.

Out of 20 existing MAS-bred rice lines that had been introgressed with different combinations of BB and/or tungro resistance genes and QTL from the previous

year, 10 were selected to exhibit resistance to two or three PXoo races and manifest improved resistance to tungro.

Mass screening for abiotic stress tolerance identified 104 and 46 donor lines with single and combined tolerance, respectively, to drought, saline, submergence, and high temperature stresses. Optimized screening protocol for reproductive saline stress determined number of filled grains, number of papery panicles, spikelet fertility, and grain yield per plant, as parameters for tolerance. Mutants previously developed as donors for abiotic stress tolerance were released as new commercial varieties for rainfed-drought-prone and irrigated lowland rice ecosystems.

PBD-233: Inbred Breeding for Better Rice

Norvie L. Manigbas

COMPONENT 1. DEVELOPMENT OF MODERN RICE VARIETIES WITH MULTI-ABIOTIC STRESS TOLERANCE FOR RAINFED AND STRESS ENVIRONMENTS

Hybridization and Line Generation Advance of Multiple Abiotic Stress Tolerance Lines. From all F1 to F8 lines of rainfed, saline, submergence, high and cool temperature, a total of 3,561 lines were evaluated and 2,334 lines were selected. Evaluation of 79 breeding lines for combined abiotic stress tolerance using the parallel approach identified 6 lines with combined tolerance to submergence and drought; one line to submergence and salinity. They all lines have a drought recovery of 50-62% and survival rate under submerged conditions of 77-100%.

Mass screening for abiotic stress tolerance at seedling stage:

- Drought tolerance generated 538 putatively tolerant plants, 176 plants of which were positive to DTY4.1-3; these will be advanced to RGA method. From the evaluation of 63 RILS, 25 lines were identified tolerant with 40-82% recovery.
- 1,091 lines were saline-tolerant, 543 of which remained vigorous until maturity and were tested for the presence of the Saltol QTL (417 were homozygous to the trait). Also, from 87 of 232 breeding lines were identified tolerant.
- Submergence screening generated 3,083 surviving plants. From the evaluation of 189 breeding lines, 45 (24%) were tolerant with survival rate of 75-100%, and 34 of them were positive to Sub1 gene.

Field performance of breeding lines:

- Non-stress, managed drought, and simulated rainfed growing conditions. Evaluation failed due to severe SB damage.
- Non-stress and submergence conditions. In DS, 80 of 128 elite lines evaluated had a comparative advantage of 74-134% over the tolerant check FR13A; 36 lines were positive to Sub1 gene. In WS, 19 pure line selections from adverse-released varieties and 20 RCEF (IL) varieties were evaluated. Survival rate after 21 days from de-submergence was 1-58%; only 6 lines had 39-58% survival, and no line beat FR13A (check). Yields under non-stress were 2.4-4.9t/ha; with stress were 0.21-1.32t/ha.
- High temperature conditions. Sixty-three ON lines had spikelet fertility of 54.32-89.47%: 6 lines were moderately tolerant; 40 were tolerant; and 17 were highly tolerant. In PYT, 147 entries were screened: 22 lines were highly tolerant (81.69-88.79%); 92 were tolerant (61.89-80.98%); 28 were moderately tolerant (48.98-79.94%); 5 were susceptible (<11%) to highly susceptible. Grain yield data were unreliable due to severe infestation of stemborer.
- Cool temperature condition. Thirty-eight ON lines were evaluated for yield and other agronomic traits as compared with NSIC Rc566 and those with 5% higher yields were selected. The test entries yield ranges from 2.583 to 3.809t/ha while NSIC Rc 566 had only 2.483t/ha.

Evaluation of breeding lines for pests and diseases resistance and grain quality:

- Evaluation of 49 Sal-Sub lines for rice blast: 27 (55%) were resistant; 5 (10.2%) were intermediate and 19 (39%) lines were susceptible. Evaluation of 59 HT lines for blast disease: 2 were intermediate; 50 resistant; and 7 susceptible. All lines were susceptible to BPH, GLH, and Tungro. BLB testing of 25 lines: 3 were intermediate; 16 resistant; 3 susceptible. All lines were susceptible to sheath blight; 2 intermediate, while 23 were resistant to SB damage.

Grain yields of promising lines in adverse locations:

- For salinity: 13 lines evaluated in two locations averaged 2.563-4.292t/ha; 5 checks had 2.383-4.121t/ha.
- For HT: 10 lines tested in three locations averaged 2.528-3.934t/ha; 4 checks yielded 1.916-5.259t/ha.
- For CT: 13 lines evaluated in two locations yielded 1.942-4.878t/ha; 3 checks had 3.185-5.861t/ha. Data in submergence have yet to be consolidated.

COMPONENT 2. DEVELOPMENT OF MODERN RICE VARIETIES FOR IRRIGATED LOWLAND

- Hybridization of TPR and DWSR generated 56 crosses; for F1 87 superior lines were bulk-harvested to advance to F2 nursery. For special purpose (SP), 1 aromatic, 25 pigmented, and 17 Zn/Fe; for VEM, 27 new crosses were generated.
- In pedigree nursery (F2-F7), 2,915 (DSR and TPR) 3834 (SP) entries were established in the dry season (DS) with 3,427 plants/lines advanced for evaluation. In WS, 3,065 entries were established in DWSR and TPR, with 3,074 plant/line selections. For SP, 2,549 lines were evaluated, 2,041 of which were selected. In VEM nursery, 23 derived lines in DS and 42 lines in WS were evaluated and selected.
- The 36 TPR and 50 SP uniform lines selected in DS, and 116 DWSR/TPR, 73 P, Zn/Fe, and 27 VEM lines in WS based on overall phenotypic acceptability were advanced to the observation nursery (ON).
- For AG and SV tolerance, 74 F2 populations and 73 ON under field conditions and 72 breeding lines under screen house conditions were evaluated. Under field conditions, 10 F2 populations and 6 breeding lines had excellent tolerance; 13 F2 populations and 6 breeding lines had good tolerance in both tests; 8 breeding lines had intermediate AG tolerance under screen house conditions.
- For lodging resistance, 73 ON breeding lines were evaluated, of which 10 lodging-resistant lines had pushing resistance (PR) of 1.50-1.54kgf.
- Field performance of advanced and elite breeding lines in the ON and PYT for DWSR and TPR:
    - ON-DWSR: 73 advanced breeding lines were re-evaluated in WS, 16 of which yielded 3.997-5.128t/ha; two lines were tolerant to AG, lodging, BLB, BPH, and had Grade 1 head rice recovery.
    - ON-TPR: 118 breeding lines were evaluated, 5 of which yielded 4.291-4.818t/ha (YA of 6-20% over NSIC Rc 222).
    - ON-SP: 10 pigmented lines yielded 3.946-4.515t/ha with %YA of 8-43% over Rc 19. For the Zn/Fe, 7 lines yielded 3.719-4.636t/ha (6- 32% YA over Rc 460). The 2 aromatic lines yielded 3.490-3.686t/ha outperforming Rc 218 by 11-17%.
    - PYT-DWSR. 67 elite lines were evaluated, only 3 of which yielded 5.185-4.857t/ha with YA of 5.5-12.6% over Rc 222.

- PYT-TPR. 222 lines were evaluated, categorized in two maturity groups. In the early-maturing group, yields ranged from 1.541 to 4.698t/ha and 0.9967-4.853t/ha for the medium-maturing group.

- Development of VEM promising lines
  - In AON, only the mutant derived lines from Rc218 and Rc 27 were identified.
  - Two 2 mutants from Rc218 were selected with YA (yield average) of 8.8-13.3%.
  - Three early mutants from Rc 27 showed resistant reaction to blast, intermediate to BLB, and susceptible to SHB and tungro virus.

PBD-234: Hybrid Breeding for Better Rice

Frodie P. Waing

CMS-BASED THREE-LINE HYBRID RICE

The CMS-based or three-line hybrid breeding system entails breeding of CMS (cytoplasmic male-sterile) or A line, maintainer or B line, restorer or R line, and development of heterotic F1 hybrids from crossing the improved A with R lines. The A line is maintained by its corresponding B line, while R restores the fertility of A in the derived F1 hybrid. Component breeding lines need to be improved before massive F1 hybrid generation is undertaken. The project utilized the CMS-WA (cytoplasmic male sterility- wide abortive) system of cyto-sterility in hybrid rice development.

- Experimental hybrids were generated by crossing 17 male parents (MP) with three CMS, producing 20 to 180 F1 seeds in DS; 44 MP crossed with 1-4 CMS produced 20-1000 F1 seeds per PC in WS.
- F1 testcross progenies, numbering 121, from 59 male parents were evaluated in the testcross nursery (TCN) to prospect potential maintainer and restorer lines. Nine potential maintainer lines and 10 potential restorers were identified based on phenotypic acceptability, morpho-agronomic traits, spikelet fertility and seed setting. The restorers will be crossed to their respective CMS lines to produce experimental hybrids.
- Six converted CMS lines are in the advanced backcross generation. Their maintainer line background has exerted stigma traits, Xa genes conferring BLB resistance and S5n gene.

- CMS conversion of three maintainer lines with Xa genes were advanced to BC7. At BC5 generation, two lines showed 100% CS+SRSL among population, while one line showed sterility of 70% CS+SRSL. These results will undergo further evaluation to determine sterility and stability.
- Seven maintainer lines with Xa genes and 10 Korean lines were established, and were crossed to improve their genetic background and traits. Crosses were made, involving 16 combinations, but a high infestation of stemborer resulted in a limited number of seeds produced.
- In 2023 dry season, generated AxB crosses from three CMS were evaluated based on pollen sterility along with control panicles. Generated paired crosses with >30 seeds in the wet season will be evaluated in 2024 dry season.
- 14H or M132 was produced in 2023 DS with estimated seed yield of 2t/ha. Three promising hybrids were seed-produced with yields ranging from 533.64 to 1108.91kg/ha.

RCEF-FUNDED PROJECTS

RCS-002-002A: Basic Seed Production

Christopher C. Cabusora

800 panicles of pure nucleus seeds were produced for each of the 4 national recommended rice varieties (NSIC Rc 216, Rc 222, Rc 402, Rc 480); 400 panicles for each of the 13 regional recommended varieties, 16 replacement varieties, 17 new varieties, and 22 other rice varieties.

230kg-315kg of breeder seeds produced for each of the 4 national varieties; 50kg-350kg for each of the 20 regional and other varieties; breeder seed certification rate in 2023 averaged 95% respectively

15,680g of seeds of 26 rice varieties, from 35 seed requests (for research and techno-demo purposes) were served in 2023

RCA-003-002A: National Cooperative Tests (NCT) for Rice

Oliver E. Manangkil

Project Objective 1: Evaluate the yield potential, reactions to biotic and abiotic stresses, and grain quality of promising lines to determine their range of adaptability.

Accomplishment 1.1: Field Performance Trials

- 36 NCT trials were established out of 38 targeted sites; 31 promising lines for TPR and 33 for DWSR; MAT, 13 lines for TPR and 11 for DWSR.
- For WS, 25 of 48 sites were established: 31 for TPR and 33 for DWSR among other entries. No MAT and rainfed trials were conducted during the season.

Accomplishment 1.2: Evaluation for Resistance to Major Insect Pests

- 144 (DS) and 152 (WS) promising lines were evaluated in 9 sites under natural field conditions against stemborer (SB), and natural field and screenhouse conditions against brown planthopper (BPH) and green leafhopper (GLH) at PhilRice CES only.
- One of the lines tested against SB in DS showed resistant reaction for deadheart (DH), 118 were intermediate for DH and 36 for Whitehead (WH). One line was resistant to BPH while 39 had intermediate reactions. For GLH, 2 lines were resistant while 65 were intermediate. During WS, due to low SB pressure, data for DH was not valid. For WH, 3 lines had resistant reactions and 92 were intermediate. For BPH and GLH, 8 and 7 promising lines were resistant, and 12 and 16 had intermediate reactions.

Accomplishment 1.3: Evaluation for Resistance to Major Rice Diseases

- 142 promising lines from NCT 1, MAT, SPR, Saline-prone, HT, and CE were evaluated in 9 sites during the DS: 92 showed resistant reactions to blast, 13 had intermediate and the rest were susceptible. Eleven lines were resistant to Bacterial Leaf Blight (BLB) while 71 had intermediate reactions. All promising lines were susceptible to Sheath Blight (ShB) and tungro.
- For WS, 135 promising lines were evaluated in 12 sites: for blast, 80 showed resistance, 18 had intermediate reaction, and 37 were susceptible. Forty lines were resistant to BLB and 41 with intermediate reaction. All entries were susceptible to ShB and tungro.

- For 2023 DS, 197 promising lines were evaluated: 29 of them lines had good milling recovery (MR), 4 had acceptable physical attributes (PA), 74 with obtained amylose content (AC)-gelatinization temperature (GT) combination with predicted tender to slightly tender cooked rice texture and 19 with good grain quality.
- Among the SPR promising lines, a black-colored entry had the highest total anthocyanin and phenolic contents and DPPH radical scavenging activity.

Project Objective 2: Recommend to the National Seed Industry Council (NSIC) promising lines that had passed NCT standards.

- Twenty-nine NOT passers were endorsed for RTWG deliberation as possible varieties for adverse environments: 8 SPR, 5 for irrigated lowland (IL), and 16 for rainfed (RF) with yield ranges of 4872-6770kg/ha, 4995-5962kg/ha, and 3761-5119kg/ha, respectively.
- Seventeen were PR lines- 8 SPR, 3 for IL, and 6 for RF. Among the PR lines, four were recommended for Council deliberation, 2 for IL, and 1 each for SPR and RF.

EXTRA CORE PROJECTS

RTF-022-340A.Y2: OneRicePH: Demand-driven product development and deployment in target market segments

Oliver E. Manangkil

MODULE 2. Modernization of a unified national rice breeding strategy to deliver higher rates of genetic gain

In 2023DS, 14 seed kits composed of 312 elite lines and check varieties per breeding pipeline- irrigated (TELS-I, TMeLS-I, and DMeLS-I) and rainfed (DELS-R) - were dispatched to OneRicePH Stage 1 network sites, 10 of which were managed and established by PhilRice. A total of 66 PR elite lines of the 400 nominations in Stage 1 were advanced for Stage 2 in 2024DS, during the product advancement meeting on September 4-6, 2023. In 2023WS, 16 seed kits with 312 elite lines (Set 2) were dispatched.

Develop elite breeding lines suitable to target local market segments using the OneRice breeding strategy

Sixty-seven elite lines from the irrigated lowland breeding pool were characterized genotypically based on the 1K-RiCA SNP panel to assess the degree of genetic diversity and frequency of favorable alleles. Evaluation of their field performance in the DS was invalidated by severe SB infestation. Twelve populations from the elite x elite crosses were generated and were established in the RGA facility in the DS.

On-site evaluation of promising lines for combined submergence and salinity tolerance

In 2023DS, 25 elite lines were evaluated on-site in Tiwi, Albay and under control led (non-stress) environment at PhilRice CES. Water depth and electric conductivity of the Tiwi site all throughout the trial was 1-20.32cm, and 0.001425-9.31 dS/m, respectively. The Tiwi site yielded 0.52t/ha-3.36t/ha; the PhilRice CES trial failed due to severe infestation of stemborer.

MODULE 3. Deployment of market-driven priority traits in Philippine elite lines and varieties for the development of essentially derived lines

PhilRice-bred inbred varieties and elite breeding lines were identified for gene deployment using IRRI donor sources to create essentially derived lines and elite donors with priority genes. Products generated in this activity will be used as elite donors for further improvement of the PhilRice breeding pool.Seven backcross populations and 12 F1 populations in the backgrounds of NSIC Rc 160, Rc 298, and other varieties were established in a screenhouse for backcrossing activities to increase genome recovery. SNP-based genotyping showed successful introgression of genes/QTLs for priority traits. Further, 10 backcross populations and five F1 populations from crosses between PhilRice elite breeding lines and IRRI donor sources were established (2023WS) for backcrossing activities and generation advancement. Results of SNP-based genotyping confirmed the successful introgression of genes/QTLs for biotic resistance.

Variety Improvement through gene stacking and advancement in RGA

In the RGA facility, F2 plants from five populations, totaling 960, in NSIC Rc 160, Rc 402, and Rc 440 backgrounds were established for generation advance and marker-assisted selection. Later, 675/942 (71.65%) plants in F4:5 generations were selected and harvested as F5:6 seeds for seed increase cum observational nursery under field conditions. Additionally, 134 backcross populations from crosses between PhilRice varieties and IRRI donor sources were established for background genotyping.

Line improvement through trait introgression

In the RGA facility (2023WS), plants from 11 populations, totaling 1025 out of 1559 (65.74%), were selected based on the presence of introgressed genes/QTLs. Following this, 128 F6 lines from four populations were established for observational yield trial (OYT) to evaluate grain yield and phenotypic acceptability (PAcp).

Abiotic stress screening for line improvement (Drought + submergence + saline)

In 2023DS, 4,857 F2 plants from 5 crosses between IRRI donor lines and PhilRice elite lines for tolerance to drought stress were mass-screened, from which 155 (3.2%) were identified putative tolerant plants. For submergence stress tolerance, 4,165 F2 plants from 4 crosses were mass-screened, from which 678 (16%) plants survived. Mass screening for salinity tolerance at seedling stage shows that 127 out of 3,000 F2 plants from 3 crosses are putative salt-tolerant plants, from which 115 (90%) plants survived to maturity. Evaluation for complete submergence tolerance at vegetative stage of 189 F2 plants, from 2 crosses identified 148 (78%) plants putative tolerant.

Rapid line fixation using RGA and anther culture technology

In 2023DS, 16 crosses were generated, wherein the segregating populations (F2 generation) derived from 7 crosses were advanced to succeeding generations using the RGA method and populations from the other 9 crosses were advanced using the conventional pedigree method. In 2023WS, 7 crosses were made combining blast resistance and abiotic stress tolerance, in which 427 F1 seeds were harvested and currently are established for F1 plants evaluation and F2 seed generation. There were 189,360 anthers cultured in callus induction medium, and are currently in the regeneration process.

Deep-water/Floating rice

The F1 plants from the generated crosses between IRRI donor sources and deep-water/floating rice varieties for pyramiding of priority genes/QTLS for flood-prone ecosystem were established PhilRice CES during 2023DS and were subjected heterozygosity test using SC3 marker for sub1 gene. F2 plants from six cross combinations, totaling 2,304, were established in the RGA facility for generation advance and line fixation. Three IRRI deepwater lines and two traditional rice cultivars were planted and monitored.

Pest resistance reaction and grain quality characteristics of elite lines

Test entries in the stage 1 trial or multi-location advanced yield trials were submitted for pest reaction and grain quality evaluation particularly milling recovery, physical attributes, amylose content, and gelatinization temperature. In 2023DS, 312 MTPR entries were evaluated for resistance to major rice diseases

and insect pests at PhilRice CES. For blast disease, 196 entries were resistant, 28 entries had intermediate reactions, and 88 entries were susceptible. None of the entries showed resistant reactions to BLB while three entries had intermediate reactions and 308 entries were susceptible. In terms of grain quality, 20 out of 291 entries for MTPR lines served fair to good brown rice recovery, Grade 1 to Premium total milled, head rice recovery, and chalky grains, with mostly long and slender grains. For ETPR, 12 from 251 entries were labeled as promising in terms of the above traits; for DWSR, 8 from 312 entries were rated as promising.

MODULE 5. Increasing variety turnover in farmers' fields

Linking product management decisions with local seed systems in priority provinces

The expanded on-farm technology demonstration is a part of the OneRicePH collaborative project between the Philippines and IRRI, which aims to increase variety turnover in farmers' fields. The techno-demo is a 5-hectare contiguous rice area that will showcase adaptive varieties with the use of optimum nutrient management and associated technologies in order to achieve 1t/ha more harvest over baseline yield in both seasons. This techno-demo was implemented in partnership with the DA-RFOs and provincial and municipal local government units (P/MLGU).

To focus attention on the performance of adaptive varieties suitable in identified market segments:

- Nine pilot sites were established under the irrigated domain – Cabarroguis in Quirino, San Rafael in Bulacan, Sariaya in Quezon, Dingle in Iloilo, Talibon in Bohol, Palo in Leyte, Pagadian City in Zamboanga Del Sur, Valencia City in Bukidnon, and Madrid in Surigao Del Sur.
- Varieties used were from the NextGen trial results all over 9 Regions and have been the top-performing varieties (NSIC Rc 506, Rc 508, and Rc 512).
- Future sites for the rainfed domain are Iguig in Cagayan, Tagkawayan in Quezon, Trinidad in Bohol, Tayasan in Negros, Borongan City in Eastern Samar, Tambulig in Zamboanga del Sur, San Francisco in Agusan Del Sur, M'lang in North Cotabato, and Sultan Mastura in Maguindanao Del Norte. Luzon sites are funded by UPLB, Visayas by IRRI, and Mindanao by PhilRice.
- The sites also produced certified seeds that can be bought by other local farmers. For example, the Madrid partner produced 6.58ha/t of Rc 512; the Leyte seed grower-partner produced 6.55ha/t of Rc 506.

Basic Seed Production

Christopher C. Cabusora

Breeder seeds weighing 1,637kg were produced from 9 varieties planted for submergence-prone, saline-prone, and rainfed conditions in 2023DS. For foundation seeds (FS), 6 upland, saline-prone, and rainfed varieties were planted, yielding 1,132kg. For registered seeds (RS), 5 varieties for upland, rainfed, saline-prone, and submergence-prone conditions produced 1,037kg.

For 2023WS, 2,059kg breeder seeds were produced from 13 varieties planted for upland, high temperature, saline-prone, and rainfed areas. For FS, 6 submergence-, saline-prone, and rainfed varieties were planted, producing 1,328kg; for RS, 502kg were produced out of 6 varieties for upland, rainfed, and submergence-prone areas.

EXTERNAL PROJECTS

198-RTF-019: Field Performance Evaluation and Selection of GUVA lines in the Tropics

Thelma F. Padolina

GUVA lines generally thrive in temperate areas but have been tailored to adapt to Philippine tropical conditions. Breeding of cold-tolerance varieties with high yield and resistance to biotic and abiotic challenges is to be addressed. The project aims to combine the superior characters of tropically adapted indica with the cool-temperature tolerance and the distinct grain quality and palatability of japonicas. It uses conventional breeding techniques and appropriate selection methods in transferring and combining traits that are superior to both ecotypes. It helps to promote the development of japonica rice.

In 2023DS at PhilRice CES, the unusual incidence of yellow stemborer, which caused severe whitehead damage affected the yield performance in AYT. To salvage some important assessment, entries with less whiteheads damage and those with higher yields than the checks were identified. No test entry performed better than the indica check NSIC Rc 222, while with Japonica 7 or NSIC Rc 584, five AYT entries were identified.

The Preliminary Yield Trial (PYT) data were invalidated owing to high stemborer damage. In the Observational YT (OYT), 28 lines were derived from six combinations were evaluated. Five lines were very early at 55 to 70 days from sowing to 50% heading. In Benguet State University (BSU), weather conditions such as cloudiness, intermittent rainfall, high relative humidity, and low night

temperature favored severe incidence of panicle blast. Only two GUVA lines narrowly survived the severe infection and produced seeds for further test and validation.

Under CES 2023WS conditions yields ranged from 2915 to 4485kg/ha; the two best AYT lines were both early-maturing with plant stature more than 100cm. Both were comparable to NSIC Rc 584 but inferior to Rc 222. The same trend was observed on PYT: yields ranged were 2359-4189kg/ha while Japonica checks had 2690-3551kg/ha. Low yield was caused by high temperature during the flowering period at more or less 30oC and moderate to severe damage by brown planthopper. The 10 cross combinations (58 lines) evaluated in OYT also yielded low as in AYT and PYT.

Seedlings used in the BSU evaluated were more than 40 days old as a consequence of cold temperature. Slow growth was evident until the reproductive stage, disrupting field performance and pulling yield down. Test entries showed resistant to susceptible reactions to panicle blast.

Also included in BSU was an assembly of 96 new parent lines designated as crossing block (CB) materials. Similar reactions as in the yield nurseries were observed. Data gathered during the seedling to tillering stages showed different responses to leaf blast infection and cool temperature. As cooler temperature set in during the reproductive phase, flowering was disrupted and emerging grains were sterile on majority of the entries. Noteworthy, however, was the selection of germplasm from the different nurseries which produced fertile grains. Validation will show whether these materials can be utilized as parent materials for crossing.