2018
NATIONAL RICE R&D HIGHLIGHTS

HYBRID RICE RESEARCH PROGRAM

PHILRICE

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PROGRAM

HYBRID RICE RESEARCH

Program leader: Norvie L. Manigbas/ Nenita V. Desamero

EXECUTIVE SUMMARY

Hybrid rice is one of the feasible and readily adoptable technologies to increase rice productivity (Mahalingam, 2013). In the Philippines, hybrid rice yields 15-20% more than the inbred check. Based on the 2018-2022 target of the Department of Agriculture (DA), it was estimated that 1 million hectares of irrigated lowland should be planted to hybrid rice in 2022, in which 25% will be dedicated to public hybrids. To meet this target, PhilRice created the Hybrid Rice Program (HRP) and the Public Hybrid Rice Commercialization Project (PHRCP). PHRCP utilized Mestiso 20 (NSIC Rc 204H), a product of the two-line hybrid rice breeding project, as one of the two hybrids used in commercialization.

Currently, 70% of the target production of the PHRCP is dedicated to Mestiso 20 while the remaining 30% for Mestizo 1 (PSB Rc 72H). The Thermo-sensitive Genetic Male Sterile (TGMS)-based Two-line Hybrid Rice project was tasked to develop good performing two-line hybrids for the PHRCP should there be a need to change the current commercialized hybrids.

HRP aimed to contribute in attaining rice sufficiency through development of wide adaptive, high-yielding hybrid rice varieties with good agro-morphological traits, acceptable grain and eating quality traits, and resistance to major pests and diseases. The program also helped ensure adequate supply of high- quality nucleus and breeder seeds of parents and F1 hybrids in support to hybrid commercialization.

The program focused primarily on breeding research to develop high yielding, good quality, and insect pest and disease resistant CMS (cytoplasmic male sterile)-three line and TGMS (thermo-sensitive genic male sterile)-two line hybrids. It is engaged in seed production research to increase seed yield, reduce the cost of F1 seed, and hasten the adoption and spread of the hybrid rice technology. The program addressed agronomy research to increase yield and reducing cost of production. It also included seed production and purification research to develop nucleus and breeder seeds, seed quality testing, seed quality standards, and technical support in hybrid seed production and seed certification training.

The program implementation entails strong partnerships and collaborations with PhilRice branch stations, other research institutions (DA-Regional Field Offices/Research Centers), state universities and colleges, local government units, and other stakeholders. Shuttle breeding for line development (experimental hybrids and parents), field performance evaluation and selection, and quality seed production in multi-environments also needs strong commitment from partners and collaborators.

DEVELOPMENT OF CMS-BASED THREE-LINE HYBRIDS

JD Caguiat

The three-line technology provides stable male sterility (Zhang et al., 2013). Thus, further improvement of hybrid parents and wider search for superior hybrid combinations in the three-line system is of great relevance. This project aimed to: 1) develop superior maintainer and male-sterile lines with high yield, resistance to major biotic stresses, and good grain quality; 2) develop diverse restorer lines with high yield, high pollen load and good restoring ability, good morpho-agronomic characteristics, acceptable grain quality and resistance to major biotic stresses; 3) evaluate experimental hybrids in different hybrid nurseries (TCN, ON, PYT, AYT) and identify best performing hybrids with >5% yield advantage over the hybrid check and >15% yield advantage over the inbred check for nomination to multi-location yield trial (MYT) and national cooperative test (NCT); and 4) produce sufficient physically and genetically pure hybrid nucleus seeds of hybrid parent lines (A,B and R) and experimental hybrids for testcross nursery (TCN), observational nursery (ON), preliminary yield trial (PYT) and Advanced yield trial (AYT).The project has four studies covering parent line development (maintainer, male-sterile and restorer lines), evaluation and seed production of experimental hybrids.

Results showed two promising maintainer lines: PR47661H with 7.2t/ha in 2018 DS and PR48352HY-B-1-6-1-1 with 9.6t/ha yield in WS. Two CMS lines at BC7F1 plants (PR46622A) were identified and selected based on the presence of WA-CMS traits and with complete sterility. One traditional rice variety (TRV) and one Javanica germplasm were identified and confirmed having the S5n gene based on genotyping and indica x japonica testcrossing.

Another study focused on increasing the diversity of restorer lines, which could increase heterosis. Twenty potential restorer lines were selected based on yield, pest and diseases resistance, presence of Rf genes, and pollen load. These will be nominated as parent lines to the hybrid source nursery for the development of testcrosses.

For the evaluation of experimental hybrids, two hybrids, PR50909H, and PR50925H, out-yielded check varieties (Mestiso 20, Mestiso 48, Mestiso 55, PSB Rc18 except NSIC Rc 240) by 5.3% to 37.2%. While PR50920H out-yielded check varieties at 10.3t/ha, NSIC Rc 240 recorded the highest yield, 8.13t/ha, among the inbred check varieties. Eighty-three hybrids were reconstructed for ON, 65 entries for PYT with potential seed yield up to 3125 kg/ha, and 20 hybrids for MYT with estimated seed yield range of 663.5-3738.60kg/ha. Five experimental and four released hybrids as NCT checks with accumulated seeds of 132.20kg and estimated seed yield range of 800.32-2066.53kg/ha were seed produced.

Development of Superior Maintainer and Male Sterile Lines

IG Pacada, JC Bagarra, LV Gramaje, FP Waing, JM Manangkil, JD Caguiat, and NV Desamero

The continuous success of hybrid rice breeding lies mainly on the development of the hybrid parent lines; thus, superior maintainer lines are very important in hybrid breeding. Segregating population from maintainer x maintainer crosses were generated and selected resulting in 6,327 entries composed of 195 cross combinations in F3-F6 generations. Four hundred forty four plants from 55 populations in DS while 2,547 plants from 46 populations in WS were selected.

Maintainer lines composed of 16 crosses in WS and 57 crosses in DS were evaluated. Three maintainer lines of released hybrids namely IR68897B, IR80559B, PR28B, and inbred NSIC Rc 222 were also included as checks. PR47661HY got the highest yield o(7.2t/ha) in DS2018; PR48352HY-B-1-6-1-1 (9.6t/ha) in WS. Grain yield of DS were affected by typhoon. Potential maintainers were crossed to outstanding CMS lines to develop new female parent with new background. Selection was based on phenotypic acceptability and complete sterility among testcross progenies.

In 2018 DS, 12 F1 were backcrossed to its recurrent parents to generate BC1F1 crosses. Ninety-six backcross progenies composed of 65 BC1F1, 18 BC2F1, and 13 BC3F1, were observed to be completely sterile (CS). For WS, 157 progenies from 47 cross combinations with sterile to completely pollen sterility (95-100%) were selected for backcrossing. This composed of 64 BC1F1, 19 BC2F1, 25 BC3F1, 20 BC4F1, 10 BC5F1, 2 BC6F1, 3 BC7F1 and 14 BC8F1. Sixty-one F1 progenies were also forwarded to BC1F1.

Two hundred seventy plants from nine cross combinations in CMS backcross nursery were evaluated for the presence of WA-CMS traits. PR50522HY population (81 BC1F1 for DS and 10 BC2F1 for WS), PR47621A (27 BC4F1 plants for DS), PR46155A (42 BC5F1 for DS and 23 BC6F1 plants for WS), and two BC7F1 plants (PR46622A) were identified and selected based on the presence of WA-CMS traits. In addition, 14 Javanica germplasm and one traditional rice variety were identified having S5 gene using MMS primer. The identified TRV and one Javanica germplasm were also confirmed having the gene using the indica x japonica testcrossing.

Development of Diverse Restorer Lines

FP Waing, MAC Meman, JIIC Santiago, MSF Ablaza, LV Gramaje, and NV Desamero

Exploring heterosis in hybrid rice has shown great success in the improvement of rice yields. However, one of the challenges for three-line system is the development of restorer line with good restoring ability coupled with other good agronomic factors. As such, this study aimed to: 1) develop diverse restorer lines with at least 80-85% pollen fertility and acceptable grain quality and resistance to major biotic stresses; and 2) evaluate the performance of promising restorer lines for grain yield, spikelet fertility, and other important morpho-agronomic traits.

All 971 F3-F5 lines were selected and 20 F2 populations will be further evaluated in DS 2019. Fifty-one F2 plants with homozygous alleles in Rf3 and Xa23 markers were selected. Field performance, grain quality, and reaction to major insect pest and diseases of 240 advanced breeding lines were evaluated.

Based on marker genotyping, 57% in Replicated Yield Trial (RYT) and 65 % in Advanced Yield Trial (AYT) have presence of at least one Rf gene. Spikelet fertility in the RYT ranged from 32.57 to 90.97%, while 57.16 to 95.19% in AYT. In AYT, the predicted grain yield based on BLUP ranged from 5.51 to 7.23t/ha with an average of 6.29t/ha in DS, and 3.28- 4.66t/ha with an average of 3.90 t/ha in WS, as compared with the grain yield of the best performing check with 7.02 t/ha in DS and 4.13 t/ha in WS.

Grain quality traits were evaluated. Brown rice (%)ranged from 73.58 (poor) to 79.64 (fair), total milled rice (%) with 63.83 (Grade 2) to 72.26 (premium) recovery, head rice (%) of 38.72 (Grade 3)-64.98 (premium), and percent chalkiness of 2.05 (premium)- 77.26 (aa). Meanwhile, amylose content (AC) ranged from 13.57 (low) to 26.22 (high); gelatinization temperature, 2.0 (high intermediate)- 7.0 (low). In terms of disease resistance, majority of the lines have intermediate to resistant reaction to leaf blast, intermediate reaction to BLB (PXO79 race 3), and sheath blight. Potential restorer lines with Rf genes but lacking tolerance to biotic stresses will be introgressed with BLB and tungro resistance genes.

Twenty potential restorer lines have been selected based on high yielding capacity, phenotypic acceptability, presence of Rf genes, high pollen and spikelet fertility, with resistance to major insect pest and diseases and with acceptable grain quality. These lines will be nominated as parent lines to the hybrid source nursery for the development of testcrosses.

Field Performance Evaluation of Experimental Hybrids

JD Caguiat, FP Waing, MSF Abaza, VP Luciano, LV Gramaje, NV Desamero, and NL Manigbas

This study aimed to: 1) evaluate the performance of experimental hybrids in the testcross nursery (TCN) based on fertility, sterility, and other important morpho-agronomic traits; and 2) prospect potential maintainer lines (B) or restorer lines (R) based on the performance of experimental hybrids, and 3) estimate the combining ability of hybrid parent lines.

Of 403 pollen parents evaluated in the testcross nursery, 94 lines were identified as potential restorers and 67 potential maintainer lines were selected based on the sterility for potential maintainer, fertility for potential restorer, phenotypic acceptability, and uniformity. In the observational nursery, 40 experimental hybrids along with the check varieties Mestiso 20, Mestiso 48, Mestiso 55, PSB Rc18, and NSIC Rc 240 were evaluated. Eleven hybrids with yield advantage of 6.6 – 44.6% were identified in DS while 15 hybrids showed better yield with 13.9–206.3% more than check variety, Mestiso 20 (highest yielding hybrid check).

In the DS preliminary yield trial, three hybrids PR50920H, PR50909H, and PR50925H with grain yield of 7.9-10.3t/ha, out-yielded check varieties except NSIC Rc 240 by 5.3 to 37.2%. Elite hybrid PR50920H out-yielded all the check varieties with yield of 10.3t/ha.

Seed Multiplication of Experimental Hybrids and Parent Lines

LV Gramaje, JD Caguiat, MSF Ablaza, VP Luciano, PLH Duran, MV Corpuz, FT Waing, NV Desamero, and NL Manigbas

This study aimed to: 1) produce sufficient physically and genetically pure nucleus seeds of hybrid parent lines (A, B, and R); 2) produce seeds of experimental hybrids for TCN; 3) produce sufficient and genetically pure seeds of experimental hybrids for observational

nursery (ON), preliminary yield trial (PYT), Advanced Yield Trial (AYT) and National Cooperative Test (NCT); and 4) identify hybrids with 1.5 t/ha AxR seed yield for nomination to multi-location yield trial (MYT) and NCT per year.

There were 409 effective crosses generated to produce the core seeds of 10 CMS and maintainer lines. Production of nucleus seeds were also achieved in 14 CMS lines during the dry and wet season with accumulated seeds of 10.57kg. Basic seeds of 13 AxB combinations were produced with accumulated seed yield of 139.09kg providing adequate supply for SPON, SPPYT, SPMYT, and SPNCT in 2019 DS. Maximum seed yield performance recorded for AxB was 1392kg/ha.

Seeds of experimental hybrids were also produced following the hill to hill, isolation-free, and row-crossing method of AxR seed production. There were 1,744 crosses generated from the TCN and 83 hybrids reconstructed for ON. Sixty-five crosses were produced for PYT with seed yield ranged from 20.2 to 207.8g and with potential seed yield up to 3,125kg/ha. Moreover, 20 hybrids for MYT were produced with estimated seed yield ranging from 663.5 to 3,738.60kg/ha from five hills sample plants replicated three times. NCT entries were also seed produced in five experimental and four released hybrids for checks with accumulated seeds of 132.20kg and estimated seed yield ranging from 800.32 to 2,066.53kg/ha.

For commercially released hybrids, seeds from paired crosses were established in wet and dry season to produce the breeder or the basic seeds of the parent lines. Initial data such as the heading and flowering days and other morphological characteristics were also gathered in this stage. It was noted that CMS and B-lines flowers at 86-97 days.

DEVELOPMENT OF THERMO-SENSITIVE GENETIC MALE STERILE (TGMS)-BASED TWO-LINE HYBRID RICE

MAT Talavera

This project aimed to develop stable and improved TGMS lines, superior pollen parents, and better-performing two-line hybrids than current commercialized hybrid varieties. Using TGMS technology in developing hybrid rice varieties adapted in the Philippines, the project composed of six interrelated studies. Three studies were devoted for developing both female and male parent lines, two studies for generating experimental hybrids, and one study for evaluating field performance of new and promising experimental hybrids.

The products of TGMS and pollen parent line development were used to generate new experimental hybrids. The F1s were tested in Hybrid Observational Nursery (HON). Promising hybrids identified in HON underwent F1 seed reconstruction to have sufficient seeds for hybrid preliminary yield trial (HPYT) and advance yield trial (AYT). Only the best performing hybrids were nominated to the National Cooperative Testing (NCT) for countrywide performance evaluation.

Female (TGMS line) and male (pollen parent) parent lines were developed thru hybridization method and recurrent selection. Utilizing both breeding methods ensured that the project could utilize both major and minor genes in developing TGMS and pollen parent lines.

For TGMS line development, the male sterile environment (MSE) breeding nursery was located at the UPLB Central Experiment Station while the male fertile environment (MFE) breeding nursery was in Benguet. For each filial generation, plant evaluation and selection were done for both MSE and MFE until the desired homozygosity was achieved. Nine hundred ten F2 populations and 1,895 lines from F3 to F6 generations at MSE were evaluated. There were also 2,940 plants/lines shuttled to MFE for further evaluation and seed increase. Five new TGMS lines were at the final stage of evaluation. These new TGMS lines were used as parents in the development of new experimental hybrids for assessment of combining ability and yielding ability of F1. Thirty F6 lines were at final phase of evaluation.

For pollen parent development, 782 F2 populations, 785 lines from F3 to F6 generations, and 10 fixed lines were evaluated. Thirty-four new pollen parents developed by the project were further evaluated in the Pollen Parent Observational Nursery (PPON) for agronomic traits, field resistance against insect pests and diseases, flowering behavior, grain quality, yield, and combining ability. Results showed that two pollen parents attained yield comparable with the highest-yielding inbred check Rc 222. RPP7 42 and RPP6 241 had grain yield of 7,714 and 8,036kg/ha, respectively, while the inbred check Rc 222 had grain yield of 7,354kg/ha. Both pollen parents were medium maturing and had a plant height of at least 100cm and intermediate amylose content and gelatinization temperature (AC/GT) combination. Eight pollen parents were also identified to have intermediate or low AC/GT combination. These pollen parents had grain yield ranging from 5,679 to 7,081kg/ha, plant height of at least 110 cm, and were medium maturing. These lines will be further evaluated in the Pollen Parent Yield Trial (PPYT) in 2019 to confirm results. For PPYT, two pollen parents were identified to have yielding ability similar with Rc 222. RPP6 119 and RPP7 36 had grain yields of 6,713

and 6,708kg/ha, respectively, plant height of at least 110 cm, and high/intermediate AC/GT combination.

To generate new and promising experimental hybrids, manual hand crossing and pollination, and isolation-free method were used. Utilizing these two techniques, the project generated 819 new experimental hybrids and 213 promising experimental hybrids ready for utilization in different levels of performance trials.

For evaluating hybrids, the project used three levels of performance trials: HON, HPYT, and AYT. HON utilized F1 seeds generated from the manual hand crossing method. Performance trial was laid out using augmented randomized complete block design, accommodating 800 entries (400 in DS and 400 in WS). HON entries were evaluated with emphasis on the PA score before expected harvesting. Only entries with high PA score were harvested and evaluated for yield. F1 seeds for HPYT and AYT were reconstructed through isolation-free method. The two performance trials were replicated, hence, 48 promising hybrids comprised the HPYT while 28 elite hybrids were evaluated in AYT.

For HON, performance evaluation identified 89 promising experimental hybrids (75 in DS and 14 in WS). These hybrids recorded grain yield better than the highest hybrid check Rc 446H (Mestiso 73). The highest-yielding hybrid entries produced 9,110kg/ha and 6,847kg/ha during the dry season and wet season, respectively. Compared with Mestiso 73, the entries had yield advantages of 23% and 14% during the dry season and wet season, respectively. All of the identified promising hybrids passed grain chalkiness.

Promising experimental hybrids identified from HON constituted entries for HPYT. Of the 48 promising experimental hybrids evaluated, four promising hybrids were identified superior than the highest-yielding hybrid check, Mestiso 73. HPYT 639 recorded the highest grain yield at 8,055kg/ha followed by HPYT 637 (7,857kg/ha), HPYT 634 (7,790kg/ha), and HPYT 636 (7,761kg/ha). These promising hybrids had acceptable degree of chalkiness and intermediate AC/GT combination.

The promising hybrids identified in HPYT comprised the entries for AYT. One hybrid was identified comparable with the highest-yielding hybrid check Rc 204H (Mestiso 20). Experimental hybrid AYT 187 yielded the highest grain at 8,046kg/ha in the dry season. This promising hybrid also passed field insect pest and disease resistance and grain quality.

Seed production research for the new hybrid in the pipeline (PRUP 13) was optimized. P line was 20cm taller than S line even without gibberellic acid (GA3) resulting in proper flower synchronization of S and P lines. With the inherent height advantage of the P line over the S line, the application of 80g GA3 per hectare resulted in 1.5t/ha average seed yield.

The purple base phenotypic marker was introgressed in the male parents of the TGMS-based hybrids Mestiso 19 and 20 through six cycles of backcrossing and selection. The purple base serves the purpose of early identification of outcrossed or selfed seeds in F1 seed lot. The purple-based pollen parent was seed increased and used to cross with the respective female parent of Mestiso 19 and 20 to generate the purple-based version. Coded as PRUP 11 and 12, these were entered into NCT under the essentially derived category.

Performance of PRUP 11 for three seasons starting from 2016 WS was deliberated during the 64th Rice Varietal Improvement Group (RVIG) annual meeting. PRUP 11 had a 5.1% yield advantage and was essentially similar to Mestiso 20 in terms of agronomic traits, disease and insect pest resistance, and grain quality attributes. Overall performance of PRUP 11 showed that linkage drag by the purple-based trait did not result in declined performance. RVIG approved the recommendation of PRUP 11 for registration to the National Seed Industry Council as a new hybrid intended for national cultivation.

Development of new and diverse TGMS lines through hybridization and selection

EE Sajise, MAT Talavera, KP Gonzales

In this study, hybridization and selection was used in transferring TGMS trait into individuals of improved genetic background. Segregating generations were handled using pedigree system while evaluation of breeding materials and fixed lines was conducted thru shuttle breeding. In shuttle breeding, sterility of TGMS breeding materials were evaluated at MSE while fertility and seed setting rate were assessed at MFE. In 2018, 80 F2 populations were established. From this, 1,246 sterile plants were selected, ratooned, and allowed to set seeds at MFE. On the other hand, 415 fertile plant selections in F2 were advanced to F3 for further segregation to select for sterile lines. In early to advance generations, 368 F3-F6 lines were selected and allowed to set seeds at MFE. To date, 41 potential new TGMS lines will undergo further evaluation (stability of sterility/fertility expression, pest and disease resistance, and grain quality) and agro-morphological characterization. These lines will also be used in generating two-line experimental hybrids to check their combining ability with available pollen parents in the collection.

Development of new and diverse TGMS lines through recurrent selection

MLG Ortiguero, BT Salazar, and KP Gonzales

Continuous development of more diverse and improved TGMS lines is essential to generate better-performing two-line hybrids. Recurrent selection is a breeding method that concentrates desirable traits on fewer individuals in the population through recurrent cycles of intercrossing and selection. Plants in the population are kept in heterozygous condition allowing more chances of genetic recombination. This method involved the development of composite intercrossing population from which potential TGMS lines with stable sterility/fertility at MSE/MFE, earliness and shorter stature, resistance to insect pests and diseases, and good grain quality were selected.

In 2018 DS, 200 F2 male fertile plant selections along with 135 F4 sterile lines and 45 F6 sterile lines were established in the pedigree nursery at MSE for evaluation and selection. On the other hand, 629 F2 plant selections (396 male fertile and 233 male sterile) and 199 F3 lines were evaluated at MSE in WS 2018. From the pedigree nursery, 347 sterile and 91 fertile plants were selected in DS while 501 male sterile plants in WS. Among the 369 male fertile populations that were segregated, 66 populations were selected for male sterile plants. In the F3-F6 generation, number of male sterile plants selected are as follows: 116 F4 plants and 60 F6 plants from DS; 107 F3 plants, WS.

In DS, five promising TGMS lines and 15 new male sterile lines were evaluated in the WS TGMS observation nursery at MSE. Plant height of the entries ranged from 70 cm to 91 cm while tiller number is from 10 to 19. Number of days to heading is between 88-101 days after seeding. Panicle exertion of all entries evaluated was above 40%. Among the RS entries evaluated, RS 77 showed high susceptibility to rice tungro virus. The lines were used as parents in the generation of new experimental hybrids for combining and yielding ability evaluation.

Identification and development of pollen parents for two-line hybrids through recurrent selection

MAT Talavera, MLG Ortiguero, and KP Gonzales

Essential to hybrid development programs for both two-line and three-line systems include the availability and identification of potentially good-performing pollen parents. Recurrent selection is a cyclical improvement technique, which aimed to gradually concentrating desirable alleles in a population. Interbreeding populations were established using the genetic male sterility mechanism. Extraction of segregating lines in developing new pollen parents were handled using pedigree breeding, while the recurrent cycle of intercrossing and selection were done continuously.

Three composite populations were established. There were 782 F2 populations, 761 lines from F3 to F6 generations, and 10 fixed lines (5 in DS and 5 in WS) established and evaluated. From the three composite populations, 758 F2 lines were extracted while 387 lines from F3 to F6 generations were selected and advanced the following season. For performance evaluation nursery, 34 and 11 pollen parent lines were entered in pollen parent observation nursery (PPON) and pollen parent yield trial (PPYT), respectively. These lines were evaluated for agronomic, yield, insect pest and disease resistance, and grain quality characteristics. For yield and grain quality evaluation, nine pollen parents in the PPON were recorded to have yields comparable with Rc 222 while eight lines had low or intermediate AC/GT combination. Yield of two pollen parents and grain quality in the PPYT are also comparable with Rc 222.

Development of two-line experimental hybrids

EE Sajise, MAT Talavera, and KP Gonzales

Increasing the number of experimental hybrids for evaluation and testing increases the chances of finding good heterotic hybrids. To generate two-line experimental hybrids, at least 11 TGMS lines and 100 pollen parents were assembled and employed with staggered planting. Lines used in the generation of experimental hybrids were composed of TGMS lines and pollen parents developed through the project. Elite lines from the UPLB rainfed and wide hybridization breeding nurseries were also used. At flowering stage, new experimental hybrids were produced either by hand crossing or using the isolation-free method. The new 819 experimental hybrids composed the HON for preliminary performance testing and evaluation.

Evaluation and field performance testing of promising two-line hybrids

MAT Talavera, BT Salazar, MLG Ortiguero, EE Sajise, and KP Gonzales

To find heterotic two-line hybrids, a large number of experimental hybrids are generated every season for testing and evaluation. Each experimental hybrid and check used was evaluated for PA and agronomic and yield characters. Experimental hybrids with yield better than the highest-yielding check were identified and will be validated.

Of the 400 entries evaluated in HON, 89 new experimental hybrids (75 in DS and 14 in WS) were found superior than the highest-yielding check, Rc 446H (Mestiso 73). The highest-yielding hybrid entries produced 9,110kg/ha and 6,847kg/ha during the dry season and wet season, respectively. Compared with Mestiso 73, the entries had a yield advantage of 23% and 14% during the dry season and wet season, respectively. Majority of the promising hybrids identified were early maturing (<86 days to 50% flowering), of short stature (91-95 cm tall), and had 11 tillers per plant.

In HPYT, four of the evaluated 48 promising hybrids yielded higher than the check variety (Mestiso 73). HPYT 639 showed the highest yield (8,055kg/ha) followed by HPYT 637 (7,857kg/ha), HPYT 634 (7,790kg/ha), and HPYT 636 (7,761kg/ha). HPYT 636 belongs to the early maturing group (Group 1), while HPYT 639, 637, and 634 belong to the medium-maturing group (Group 2). Four promising hybrids had mean plant height ranging from 97cm to 111cm with an average of 12 tillers per plant.

Twenty experimental hybrids evaluated for AYT did not surpass the highest-yielding hybrid check Mestiso 20 during dry season and Mestiso 73 during wet season. For DS evaluation, the highest-yielding experimental hybrid AYT 187 produced 8,046kg/ha while 8,175kg/ha were harvested from Mestiso 20. For the wet season, hybrid entry AYT 187 recorded the highest grain yield (6,084kg/ha). The highest-yielding hybrid check Mestiso 73 produced 6,579kg/ha. Hybrid entries with yield advantage of less than 5% will be retested the following season.

F1 seed production of two-line hybrids for testing and evaluation

BT Salazar and MAT Talavera

This study aimed to produce sufficient amount of F1 seeds for testing and evaluation and to initially determine the F1 seed production capacity of promising hybrids. The modified chimney and isolation-free method as described by Virmani et al. (2003) were adopted in producing seeds for HPYT and AYT, while smaller S x P seed production plots were established for hybrids intended for NCT, agronomic trials, on-farm trials, and field demonstration plots.

There were 213 promising experimental hybrids reconstructed using isolation-free method. From these, 100 promising hybrids with at least 100g of seeds per hybrid were evaluated in HPYT and AYT the following season. Initial seed production practices of the new hybrid in the pipeline were optimized.

HYBRID SEED AND HYBRID SEED PRODUCTION RESEARCH

SR Brena

The project consisted of seven studies namely: HRP 004-001, Evaluation of flowering behavior and pollen dispersal in new hybrids in different locations, seasons, and time of the year; HPR 004-002, Development of possible alternative for the control plot in TGMS hybrid seed certification; HRP 004-003, Staggered planting of TGMS lines in MFE for increased seed yield and quality; HRP 004-004, Assessing the seed quality, purity and genetic identity of public hybrids produced at PhilRice; HRP 004-005, Utilization of SSR markers for seed purity testing in TGMS hybrids; HRP 004-006, Effectiveness of storing seeds of hybrid parents at mid-elevation sites under ambient conditions; and HRP 004-007, Evaluation of flowering synchronization techniques and optimum row ratio for increased seed yield in hybrid rice production.

Evaluation of Flowering Behavior and pollen dispersal in new hybrids in different locations, seasons and time of the year

AGS Ferriol, SR Brena, and MO Palanog

The cultivation of hybrid rice is a technology that allows for an increase in grain yield of 20-25% relative to the grain yield of conventional cultivars (Janaiah and Hossain 2000). However, the main challenge for this technology is related to seed production, which currently has high production cost and low seed yield. Therefore, agronomic techniques that could enhance flowering synchrony of parent lines in the field are essential for an efficient production system of hybrid rice seeds. This study looks into pollen density, dispersal and flowering behavior, that would consequently, enhance flowering synchrony and outcrossing between parent lines in the production of hybrid rice seeds. The experiments were conducted for two growing seasons at PhilRice CES and Negros station. All experiments were conducted as randomized complete block in a split plot scheme. Glass slides positioned with the S-line parents (PRUP TG101) that were near to the pollen source appeared to have higher pollen density than those in the middle rows (4, 5, and 6). It was observed that highest percent of pollen grains dehiscence was achieved from 10:30 to 11:00am. Time of anthesis between parent lines differ by more than two and a half hour with female parent (PRUP TG101) flowering earlier 7:30am than male parent (SN 758), which flowered at 09:45am resulting in a narrow window of synchrony. The asynchronous flowering resulted in many spikelets of S-line parent not being available for cross-pollination. With this condition, it is suggested that supplemental pollination should be done at the peak of floret opening to increase the rate of cross-pollination.

Development of possible alternative for the control plot in TGMS hybrid seed certification

SR Brena, AGS Ferriol, and MO Palanog

TGMS seed production is governed by the latest Administrative Order No. 8 series 2012 which requires 40 m^2 control plot (CP). One CP can be used by hybrid seed growers provided they established the SxP seed production of one TGMS variety on the same day. The CP is established to measure the degree of selfing in the SxP. However, hybrid seed growers find

it difficult to establish the CP owing to isolation issues. More TGMS hybrid seed growers in other locations in Mindanao other than Davao Oriental will engage in TGMS seed production if there will be a substitute for the CP. This study was conducted to look for possible alternative for the CP. Bagging of S-line panicles in SxP seed production before panicle emerged was tried at CES, PhilRice Negros and in hybrid seed grower fields in Banay, Banay, Davao Oriental, in both DS and WS planting. High seed yield was obtained in both control plot and the bagged panicles of PhilRice CES SxP hybrid set-up. Seed yield in SxP seed experimental field was also high owing to low temperature (<30 ^{0}C) from panicle initation to onset of flowering. Bagging of S-lines at PhilRice Negros and Davao SxP seed production during DS, favorable seed yield from all replications were obtained. In WS, same locations were used for SxP seed production and bagging of S-line panicles. Higher seed yield was collected from bagged panicles in all SxP seed production location than in DS. Low seed yield was obtained in the CP. Seed set in the bagged panicles was high owing to worn-out and damaged mesh bags used; thus, S-lines were pollinated using supplementary pollination. Low seed yield obtained in the CP cannot be attributed to low temperature but to isolation. In Davao, TGMS hybrid seed grower rented 40m^2 area to establish the CP. Lower seed yield was gathered from control plot than from bagged S-lines due to worn-out and damaged mesh cloth. Wider holes in used mesh bags were observed because of multiple use in trials. Weight of the filled grains obtained in the bagged S-line panicles was lower than the weight of the filled grains in CP. Bagging S-lines inside SxP was observed to be a good process for the CP.

TGMs hybrid seed growers that used the same control plot obtained seed yield of more than 1,200kg/ha. In AO No. 8 series 2012, 4% maximum allowable selfing in the control plot was allowed. The seeds in CP and those in the bagged panicles was less than 4%; thus, the seed yield in SxP was certified.

Staggered planting of TGMS lines in MFE for increased seed yield and quality

MO Palanog, SR Brena, and AGS Ferriol

Maximizing seed yield in parent seed production may help in attaining hybrid seed requirement of the country. However, it is empirical that yield-limiting factors should be addressed to optimize the parent seed production. Timing of planting that coincides with favorable climatic conditions particularly temperature and appropriate nutrient management are crucial factors to consider in optimizing seed production yield at MFE. A field experiment was conducted to determine the appropriate planting schedule(s) and nitrogen level and timing that will increase grain yield of parent S-line. Initial results showed that grain yield was very low across five planting dates (February 21, March 8, March 23, April 7, and April 22, and from February to April 2018) and nitrogen level treatments: 1) existing nutrient management practice -50% N at planting + 50% at 15 DAT; 2) 50% N at the time of planting + 25% N 15 DAT +25% N 25% DAT; 3) 50% N at the time of planting + 25% N at 25DAT +25%N 35 DAT; and 4) 25% N at the time of planting + 25% N at 15DAT +25%N 25 DAT + 25% N 35DAT. The low grain yield may be attributed to the high temperature (25^{0}C) and low moisture (52% RH and low irrigation water supply) during the critical growth stages of the rice plant which resulted in low spikelet fertility. Among the planting dates, mid-March planting (P3) consistently obtained the highest grain yield while T1 and T4 obtained the highest grain yield across planting dates. The combination of P5 planting date and Treatment 4 (P5T4) obtained the highest grain yield among 5 planting dates and 4 nitrogen level treatments.

Analysis of variance showed a highly significant variation of grain yield response under various planting dates and significant variation in the planting dates x treatment interaction. However, no significant variation on the response of grain yield under various nitrogen treatments was observed. The result possibly indicates that nitrogen application alone cannot address the nutrient problem in the soil and multiple-nutrient management should be considered.

Assessing the Seed Quality, Purity, and Genetic Identity of Public Hybrid Parent Lines Produced at PhilRice

CRB Flora

It is estimated that 1% impurity in the hybrid seed can lead to yield reduction of 100kg/ha (Mao et al., 1996). Admixtures in the rice seeds may diminish the value of the crop. The full potential of hybrid seeds can be explored only if the seeds are genetically pure. Determination of the genetic purity of the hybrid parent lines and hybrids is normally done using the conventional grow-out test (GOT) before the seeds of public hybrid parent lines produced by PhilRice are distributed. Generally, only parent lines with 97% and higher genetic purity after GOT are distributed. At this level of genetic purity, minimal off-types are observed in the field when the parent lines are planted.

The study evaluated the genetic purity of various parent lines produced in 2017 WS and 2018 DS. Identification of off–type was based on color of the base, height, leaf color, heading period and grain characteristics. In 2018, 55 and 83 seed lots were planted in GOT in DS and WS, respectively. GOT field matrix consisted of 33 seed lots of BS and 22 seed lots of FS lots in DS.

In WS, 11 seed lots were planted to BS; 21, FS; 51, hybrids. All the parent lines had >97% genetic purity. Only three BS seed lots of IR58025A, the female parent of Mestizo 1, produced in PhilRice Los Baños in 2017 WS failed to meet the 97% genetic purity. The average genetic purity was only 89.5% TGMS hybrids produced in 2018 DS in Davao Oriental had more than 99% genetic purity. The high genetic purity from BS and FS was carried over in the production of the TGMS hybrids.

Utilization of SSR Markers for Seed Purity Testing in TGMS Hybrids

CRB Flora

The genetic purity of rice hybrids was conventionally assessed through GOT. However, the method is time consuming, space demanding, and environment dependent. Microsatellites or simple sequence repeat markers are considered useful in genetic purity and diversity studies owing to its multi-allelic nature, high reproducibility, co-dominant inheritance, abundance and extensive genome coverage, and simple reproducibility. PRUPTG102 and TG102M, BS of parent lines of Rc204H (Mestiso 20), were evaluated for genetic purity using the SSR molecular markers. They were produced in 2017 WS and 2018 DS from Benguet, Isabela, and Negros Occidental. FS from Negros Occidental and PhilRice Negros for TG102M were also evaluated. There were 22 BS seed lots of PRUPTG102; 16 FS seed lots produced in Kayapa, Nueva Vizcaya and DSB, Negros Occidental; and 6 FS seed lots of TG102M analyzed in 2018 DS. In 2018 WS, 12 FS seed lots of PRUPTG102 from PhilRice Isabela and PhilRiceNegros together with 9 FS seed lots of TG102M from PhilRice Negros were assayed.

BS seed lots of PRUPTG102 had higher than 99% genetic purity. Genetic purity of FS seed lots of PRUPTG102 and TG102M was higher than 98%. Among the three molecular markers

used, RM1 detected more off-types in PRUPTG102 than either RM127 or RM511. However, for TG102M, RM511 detected more off-types in the seed lots tested. The study proved that although the use of molecular markers in genetic purity analysis may incur high costs in initial run, it saves time and space in the long run.

In 2018 DS, 22 BS and 16 seed lots of PRUPTG102 showed comparable results (99.45% in GOT and 99.7% in molecular marker for 22 breeder seed lots of PRUPTG102. BS of PRUPTG102 were produced in WS 2017 and evaluated for genetic purity through grow-out test (GOT) and molecular marker.

Likewise, 99.24% was achieved in GOT for 16 FS seedlots of the same parental lines and 99.37% using molecular markers. Very slight difference was noted in 12 FS seed lots evaluated in 2018 WS. Genetic purity (99.32%) was achieved in GOT and only 98.8% using molecular marker.

Effectiveness of Storing Seeds of Hybrid Parents at Mid-Elevation Sites under Ambient Conditions

BT Salazar, W Abonitalla, and LV Guittap

Low temperature environment is critical in seed production of TGMS parent line. The study was conducted from January to November 2018 to determine if mid-elevation environment can be effective in keeping seed viability and seedling vigor of TGMS hybrid parent lines. A 3x2x2 factorial experiment was laid out in split-split plot design with storage environment (ambient storage room, cold storage room, and mid-elevation storage room) as main plot, storage container (ordinary sack, and ordinary sack with plastic liner) as subplot, and hybrid TGMS parent line (M20 female parent and M20 male parent) as sub-subplot. Seed testing commenced before storage and every two weeks thereafter until 54 weeks after storage (WAS). Seed viability was assessed using filter paper method, while seedling vigor (SV) was evaluated using SH (seedling height) and GP (germination percentage) parameters. The interaction of environment, container, and parent genotype used significantly influenced GP, SH and SV. Generally, GP, SH, and SV decrease as storage duration increases. The decline is more prominent in hybrid parent seeds packed in ordinary sack and stored in ambient condition. Cold room storage resulted in seeds with high GP, SH, and SVI. Furthermore, MFE storage can also extend GP, SH, and SV provided that seeds are fumigated before storage and packed in sack with liner to maintain its viability and vigor until 54 weeks. After 18 weeks, GP of S-lines packed in sack stored in MFE remained 81% but those in ambient had only 49%.

Evaluation of flowering synchronization technique and optimum row-ratio for increased seed yield in hybrid rice seed production

LV Gramaje, MSF Ablaza, VP Luciano, PLH Duran, AV Capistrano, JJE Aungon, J Galapon, and AL dela Cruz Jr.

Synchronization of flowering is one of the constraints in hybrid seed production. To solve this barrier, leaf counting was used to determine differential seeding intervals of parent lines in AxR seed production of Mestiso 32 and Mestiso 55 established at CES and PhilRice Isabela in DS and WS.

Leaf number of M32 and M55 parents was gathered from seedling to flag leaf emergence in 10 sampled plants. M32's female parent (IR68897A), under Isabela condition, registered an

average leaf number of 13.6 and 14.86 in DS and WS, respectively. Meanwhile, male parent (IR73013R) had 13.5 leaf count in dry and 15.47 in WS. Sowing may be done in the same day in DS, and CMS or female parent should be sown 1.5 days after the male R-line was seeded. Under Nueva Ecija condition, IR68897A had an average leaf count of 13.9 and 16. 33 in DS and WS, respectively; while 14.7 in DS and 19.33 in WS for male parent. The female CMS line should be sown after one first true leaf emerged in male parent during DS. On the other hand, female parent in the WS should be sown when male parent had developed three leaves.

For Mestiso 55 under Isabela condition in DS, 1.43 leaf difference was observed between IR79128A and PR35119-AR32-4-3-2R, suggesting that CMS lines can be sown when 1.43 leaves emerged in male parents. In WS, 0.37 leaf count difference was observed between the parents IR79128A and PR35119-AR32-4-3-2R. Female parent should be sown when 0.37 of leaves emerged in male parents.

Row ratio of Mestiso 55 was established using 3:9.3:12, 3:15, and 3:18 to determine seed yield per plant, seed yield per hectare, and outcrossing rate. No significant difference was observed for the three parameters. However, the ratio of 3:15 exhibited the highest seed yield per plant and per hectare. The ratio of 3:12 obtained the highest outcrossing rate of 17.88%. In WS, the row-ratio of 3:9 attained the highest seed yield per hectare of 1,114.83kg/ha and 26.05% outcrossing rate.

SCREENING OF CMS AND TGMS PARENTALS, BREEDING LINES, AND PROMISING HYBRIDS FOR GRAIN QUALITY AND RESISTANCE TO MAJOR INSECT PESTS AND DISEASES

BT Salazar

This project aimed to evaluate the CMS and TGMS parentals and promising hybrids for grain quality, and resistance to major pests. Only the identified CMS and TGMS parentals and promising hybrids with acceptable grain quality, and resistance to major pests will be used in the breeding program. To facilitate efficient evaluation of entries, the project is divided into two groups: CMS-based entries are evaluated at CES, while TGMS entries are handled by PhilRice LB and UPLB. The number of materials and the type of evaluation depends on the request of the plant breeders. Evaluation of entries follows the NCT method of grain quality and insect pest and disease screening.

Screening of CMS Parentals, Breeding Lines, nd Promising Hybrids for Grain Quality

EH Bandonill, JCA Cacerez, LC Castillo, OC Soco, F Waing, and BT Salazar

Early screening for grain quality can significantly contribute to a cost-effective and efficient breeding program. Hence, efforts of using more genotypes to further increase the likelihood of commercial success of hybrids needs to be strengthened. To identify CMS parentals, breeding lines, and promising hybrids with acceptable grain quality, 34 usable CMS-based parentals (CBP) and 408 advance breeding lines were screened in 2017 WS and 129 CBP and 42 F1 observation nursery (ON) hybrids in 2018 DS. Entries were evaluated for milling potentials, physical attributes, and physicochemical properties. In 2017 WS, 79% of the CBP had fair brown rice (BR) and Grade 1-premium milled rice (MR), while 42% had Grade 1-premium head rice (HR). Around 30% had Grade 1-premium chalky grains (CG) and 70% were long to extra-long and slender. Around 85% had low to intermediate amylose content (AC) and intermediate/high-intermediate gelatinization temperature (GT) (tender when cooked). Only PR34302R had high AC and low GT, which was predicted to have hard texture. From the advanced breeding lines, 97% had fair BR; 96%, Grade 1-premium MR; and 62%, Grade 1-premium HR. Around 35% had Grade 1-premium CG, 79% were mostly long and slender, and 58% had low to intermediate AC and intermediate/high-intermediate GT.

In 2018 DS, 73% of the CBP had fair-good BR while 53% and 19% had Grade 1-premium milled and HR, respectively. For chalky grains, 39% were classified as Grade 1-premium while 84% belonged to low and intermediate AC. Among F1 ON hybrids, all 42 entries passed the standard for BR and 57% had Grade 1- premium HR. Only 15% had Grade 1-premium CG and 76% had low and intermediate AC.

Grain Quality Evaluation of TGMS Parentals, Breeding Lines and Promising Hybrids

BT Salazar, AQ Jumawan, EE Sajise, MAT Talavera, and MLG Ortiguero

A more efficient breeding program requires early screening for grain quality. Materials with unacceptable grain quality should be discarded at earlier stages of breeding. The study is conducted to evaluate the grain quality of TGMS parentals, breeding lines, and promising hybrids following the NCT method of grain quality evaluation. In 2018, 402 entries from 11 different nurseries were evaluated for either apparent amylose content (AC) only, gelatinization temperature (GT) only, or both AC and GT. The number of entries and the type of evaluation were based on the needs of the breeders. Results showed that majority (52%) of the samples had intermediate AC, while 25% had high AC, and the rest had low-very low AC. On the other hand, 76% of the samples exhibited intermediate GT, 15% had low and 9% had high GT. Forty percent of the samples had intermediate AC-GT. When clustered together, 79.94% of the samples belong to cluster 1 soft texture and cluster 2 intermediate texture cooked rice, indicating good eating quality. This implies that majority of the entries evaluated had acceptable grain quality and will most likely be used by the breeders in the development of hybrid rice varieties.

Evaluation of CMS Parentals, Breeding Lines and Promising Hybrids for Resistance to Major Insect Pests and Diseases

GS Rillon, JP Rillon, FP Waing, IV Boholano, GB Amar, CU Seville, SE Santiago, ND Santiago, CCB Encarnacion, CJ Parina, and JIIC Santiago

The improvement of a high quality hybrid with resistance to major insect pests and diseases is one of the major concerns in the hybrid rice program. However, the superior yield advantage of hybrid to inbred could be affected by susceptibility to pests. To provide the need to identify a high quality hybrid with resistance to major insect pests and diseases, hybrid parentals (HP), observational nursery (ONH), and SCN (source nursery) promising hybrid entries were evaluated for resistance to major rice diseases such as blast, bacterial leaf blight, sheath blight, tungro, and major rice insect pests like stemborer damage (deadheart and whitehead), green leafhopper, and brown planthopper. Fifty-five HP and 42 ONH were evaluated during the dry season at PhilRice CES while 297 SCN entries during the wet season at PhilRice stations in CES, Midsayap, Isabela, and Negros. Of these hybrids, 18 HP, 22 ONH (PhilRice CES), 165 SCN (PhilRice CES), 142 SCN (PhilRice Isabela), 70 SCN (PhilRice Midsayap) were noted resistant to blast; 2 HP (PhilRice CES) and 50 SCN (PhilRice Isabela) resistant to BLB; and 29 SCN (PhilRice Isabela) to ShB. High incidence of tungro was observed under the modified field method of evaluation in PhilRice Negros, 11 SCN entries showed resistant reactions, 105 intermediate and the rest were susceptible to the disease. Two ONH entries were observed to have intermediate reactions to GLH while 6 HP, 8 ONH, and 73 SCN have reactions to BPH. Resistance to stemborer damage was seen at 10 days before harvest in 19 HP and 15 ONH (PhilRice CES) and 46 SCN (Midsayap).

Evaluation of TGMS Parentals, Breeding Lines, and Promising Hybrids for Resistance to Major Insect Pests

EA Magsino, JS Bantoc, and F Carandang

There were 622 entries comprising 9 nurseries evaluated for resistance against stemborer (field condition) and BPH and GLH (greenhouse). The National Cooperative Tests methodology for rice screening was followed.

Only one RSON entry (indicate genotype) was found resistant to GLH. Thirty-seven and 126 entries exhibited moderate resistance and intermediate reaction to the same insects; while 36 and 134 entries were noted to be moderately resistant and intermediate to BPH, respectively.

Evaluation of TGMS Parentals, Breeding Lines, and Promising Hybrids for Resistance to Major Diseases

BO Budot and DB Abonitalla

The study evaluated 370 entries consisting of TGMS parentals, breeding lines, and promising hybrids and analyzed their reactions to blast, sheath blight, bacterial leaf blight, and tungro under the induced method. During DS and WS, 165 and 205 entries, respectively, were evaluated. Additional 156 entries from AYT and HPT were also evaluated under field condition, results of which are being processed.

Evaluation showed that 32 (8%) entries were resistant to rice blast while 280 (77%) were susceptible. Forty-four entries (15%) showed intermediate reactions. For sheath blight, majority of the entries showed intermediate reactions (238 or 59%) while 41 (11%) and 92 (30%) of the entries were found resistant and susceptible, respectively. Half of the entries were resistant to BLB while the other half is intermediate. All entries were susceptible to the rice tungro pathogens.

HYBRID NUCLEUS AND BREEDER SEED PRODUCTION RESEARCH AND MAINTENANCE

LV Guittap

This project aimed to produce, supply, and maintain basic seeds of released public hybrids in support to the hybrid commercialization program, breeding groups, and hybrid seed research. The project supplied the required amount of breeder seeds for foundation seed production to meet national hybrid cultivation target. Studies under the project conducted initial characterization and evaluated hybrid seed reproducibility of promising hybrid parental lines and F1 from the CMS and TGMS breeding groups. The basic seeds of public hybrids are also maintained for safekeeping and for research.

As main output in 2018, the project ensured sufficient and available supply of BS upon request by PhilRice stations and FS for the seed growers. Initial baseline information on seed reproducibility of promising hybrids were generated and discussed with the breeders. The project also made available basic seeds of released public hybrids to researchers along with information on important characteristics. The project guaranteed adequate, sustained, and maintained supply of nucleus and breeder seeds of public hybrids and parents.

Hybrid nucleus and breeder seed production

LV Guittap, WB Abonitalla, AV Tandang, SR Brena and EE Sajise

The study focused on the nucleus and BS production of Mestizo 1 and Mestiso 20 parental lines. The purification process involved A-line evaluation and paired-cross generation for the three-line hybrid Mestizo 1 and plant selection at MFE and evaluation at MSE for TGMS-based hybrid, Mestiso 20.

Some 2,700 A-line plants were evaluated to initiate nucleus seed production of Mestizo 1. The A-line plants were morphologically examined, and their pollen was tested for sterility to completely identify sterile individuals for pair-crossing with selected B-line plants. There were 911 IR58025 AxB paired crosses generated for evaluation to produce new lot of nucleus seeds for Mestizo 1 A and B lines. In DS, PhilRice LB produced 45kg nucleus seeds of Mestizo 1 from 700m^2 plot, enough to plant 3ha of AxB BS production plots. Harvested seeds were kept at the cold room. For Mestiso 20, over 1,000 true-to-type PRUP TG102 individual plants were selected at MFE each season. These selected S-line plants were evaluated in MSE for sterility and trueness in agro-morphological traits. Parental lines of Mestiso 32 were also purified. For BS production, A, B, R-line of Mestizo 1 and Mestiso 20 P-lines were produced in DS and WS in Los Baños, while Mestiso 20 S-line were produced in Benguet. About 1,500kg A-line and S-lines were produced and processed enough to meet the requirement of the commercialization program. Corresponding 250kg breeder seeds of R and P-line of the hybrids were also produced during the wet season. The average yield for AxB breeder seed production in 2018 was 800kg/ha. Produced PRUP TG102 can cover approximately 30ha of S-line FS. BS of the parent lines of both hybrids were dispatched to PhilRice stations for FS production. Around 1,500kg of breeder seeds of Mestizo 1 and Mestiso 20 are kept in the cold rooms in Los Baños. They are ready for distribution to PhilRice stations and accredited hybrid seed growers as needed by the Commercialization Program.

Characterization of promising hybrid parental lines

LV Guittap, WB Abonitalla, MAT Talavera, and LV Gramaje

This study characterized parental genotypes of four promising hybrids and provided baseline information on hybrid seed reproducibility and other important traits. Breeders at PhilRice CES and LB identified PR40640H, PR46838H, PRUP 14, and PRUP 15 as promising hybrids. F1 seeds and corresponding parents were requested. A seed file for the parents and F1 of the promising hybrids were processed for future reference. The remaining seeds were used as planting materials for the characterization of the hybrid parents, testing the basic seed production capacity, and assessing F1 hybrid seed production capacity. Date to heading (DTH), plant height, tiller count, and panicle length of the parental lines were recorded. Difference in the DTH of both PR2A and B and IR80559A and B was noted. A confirmatory evaluation will be done as this is not a common observation in similar genotypes like A and B line. The difference in plant height between PR29A and 19R56 R lines of PR40640H is an advantage especially during AxR F1 seed production. Other qualitative traits were also recorded such as blade pubescence, blade color, basal leaf sheath, leaf angle, stigma color, presence of awn and its color, and culm strength. Characterization of the F1 and parent lines of TGMS hybrids is currently on-going. The seed yield level of PR29 AxB seed production during WS was 600kg/ha. This is relatively low compared with the AxB seed yield of existing commercial hybrid Mestizo 1 at 800kg/ha on the average. AxB seed production plot for PR46838H was established but was discarded due to purity issues. PRUP TG102 at MFE yielded 1,500kg/ha while PRUP TG101 obtained about 2,000kg/ha. AxR and SxP F1 seed production assessment of the promising varieties will be determined in 2019.

Fertility/sterility stability evaluation of CMS and TGMS promising hybrids

WB Abonitalla, LV Guittap, MAT Talavera, and LV Gramaje

This study evaluated the fertility and sterility stability of CMS and TGMS parent lines of promising hybrids. PR29A, female parent of PR40640H and IR80559A, and CMS-line of PR46838H were included in the study. IR80559A was not evaluated due to impurities. The issue was reported to the breeder and a new seed lot was sent to LB. There were 50 CS (completely sterile – 100% sterile), 50 S (sterile – 95 to 99.9% sterile), and 9 PS (partially sterile – 70 to 94.5% sterile) A-line plants of PR29A selected. CS plants with stained round (light) pollen were also collected for additional observations.

Initial observations indicated a negative relationship between pollen sterility and the number of plants with seed set. It was observed that 44% of the A-line plants classified as PS had at least one selfed seed. On the other hand, 18% of the plants classified S had seed set. For the CS plants, only 10% had selfed seeds. It was interesting to note that S plants and CS-SS (completely sterile but with stained pollen) plants had almost the same percentage number of plants with seed set. The average seed set per plant decreased as the percent pollen sterility increased. Plants evaluated as PS had at least one seed set per plant. Number of selfed seeds harvested from each plant was also recorded. Harvested seeds will planted the following season for further observation of seed set.

Monthly planting of PRUP TG101 and PRUP TG102 was established at PhilRice LB to determine the proper planting time of S-line establishment. Initial data showed that PRUP TG102 established from April to August experienced temperature higher than the critical

fertility point. This resulted in complete pollen sterility and no seed set. It was also observed that days to 50% heading varied from 85 to 102 days. Meanwhile, establishment of PRUP TG101 started in November 2018. The influence of temperature on pollen sterility, seed set, and other traits of the S-lines will be determined and compared after 12 months of planting.

Basic seed maintenance of public hybrid parentals

WB Abonitalla, LV Guittap, and AV Tandang

This study generally maintained basic seeds of released public hybrids for safekeeping and for research. Parental lines of 16 public hybrid varieties released from 1997 to 2016 are already available at PhilRice Los Baños. Processing of seed lots of public hybrid parentals was conducted. Processed materials were stored for maintenance in cold room at PhilRice LB with 16-20^{o}C and 40-60% relative humidity. In 2018, 28 parents of 16 public hybrid varieties were processed. The 16 public hybrid varieties included 12 CMS- and 4 TGMS-based varieties. For the TGMS-based hybrids, one new genotype for release was included. There were 244 lots of public hybrid parentals processed during the year. Aside from the hybrid parental lines, F1 of each of the hybrid varieties were also kept in storage. Processing of these F1s was standardized, and these are kept solely for research and filing. Nine F1 public hybrid varieties were kept in storage composing six CMS and three TGMS-based hybrids. In 2018, 250g each of 12 hybrid parent lines were distributed to researchers. Ten parents of CMS-based hybrids and two parents of TGMS-based hybrids at 10g for each genotype were requested and served. Seed dormancy and days to 50% heading of some hybrid parents were also recorded.

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

With a "Rice-Secure Philippines" vision, we want the Filipino rice farmers and the Philippine rice industry to be competitive through research for development in our central and seven branch stations, coordinating with a network that comprises 59 agencies strategically located nationwide.

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

PhilRice Central Experiment Station; Maligaya, Science City of Muñoz, 3119 Nueva Ecija
Tel: (44) 456-0277 • Direct line/Telefax: (44) 456-0354

BRANCH STATIONS:

PhilRice Batac, MMSU Campus, Batac City, 2906 Ilocos Norte
Telefax: (77) 772- 0654; 670-1867; Tel: 677-1508; Email: batac.station@philrice.gov.ph
PhilRice Isabela, Malasin, San Mateo, 3318 Isabela
Mobile: 0908-875-7955; 0927-437-7769; Email: isabela.station@philrice.gov.ph
PhilRice Los Baños, UPLB Campus, Los Baños, 4030 Laguna
Tel: (49) 536-8620; 501-1917; Mobile: 0920-911-1420; Email: losbanos.station@philrice.gov.ph
PhilRice Bicol, Batang, Ligao City, 4504 Albay
Tel: (52) 284-4859 to 60; Mobile: 0918-946-7439 ; Email: bicol.station@philrice.gov.ph
PhilRice Negros, Cansilayan, Murcia, 6129 Negros Occidental
Mobile: 0949-194-2307; 0927-462-4026; Email: negros.station@philrice.gov.ph
PhilRice Agusan, Basilisa, RTRomualdez, 8611 Agusan del Norte
Telefax: (85) 343-0768; Tel: 343-0534; 343-0778; Email: agusan.station@philrice.gov.ph
PhilRice Midsayap, Bual Norte, Midsayap, 9410 North Cotabato
Tel: (64) 229-8178; 229-7241 to 43; Email: midsayap.station@philrice.gov.ph

PhilRice Field Office, CMU Campus, Maramag, 8714 Bukidnon
Mobile: 0916-367-6086; 0909-822-9813
PhilRice Liaison Office, 3rd Floor, ATI Bldg, Elliptical Road, Diliman, Quezon City
Tel: (02) 920-5129

SATELLITE STATIONS:

Mindoro Satellite Station, Alacaak, Sta. Cruz, 5105 Occidental Mindoro
Mobile: 0917-714-9366; 0948-655-7778
Samar Satellite Station, UEP Campus, Catarman, 6400 Northern Samar
Mobile: 0948-754-5994; 0929-188-5438
Zamboanga Satellite Station, WMSU Campus, San Ramon, 7000 Zamboanga City
Mobile: 0975-526-0306; 0910-645-9323

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prri.mail@philrice.gov.ph

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