2020

PhilRice R&D Highlights

Hybrid Rice Program

Contents

DIVISION

Hybrid Rice Program

Program leader: Nenita V. Desamero

EXECUTIVE SUMMARY

The Hybrid Rice Program (HRP) is geared towards increasing rice production and enhancing profitability and reducing production cost per unit of cultivated area, while boosting the competitiveness of the farmers. The Program contributes in attaining rice sufficiency through development of wide adaptive, as well as location-specific high yielding, resistant to major insect pests and diseases, and of good grain and eating quality hybrid rice varieties, coupled with appropriate cultural management. The Program also ensures availability and sustained adequate supply of genetically pure and quality nucleus, breeder and foundation seeds of parents and hybrids in support to public hybrid rice commercialization and for use by researchers. The six projects (Figure 1) implemented under the Program address the development of parent lines for cytoplasmic male sterility (CMS)-based three-line hybrids and thermo-sensitive genetic male sterility (TGMS)-based two-line hybrids, streamlined mass screen vital in the introgression of resistance to major insect pests and diseases, as well as good grain and eating quality traits in the parents and hybrids. Seed and seed production research are necessary in improving the yield, reproducibility and quality of parental and F_1 seeds, which are essential factors considered in hybrid rice commercialization.

The Program employed multi- and transdisciplinary and integrated approach in the implementation of the various projects (Figure 2). The two projects, HRP-002 based at PhilRice Los Baños, and HRP-003 based at PhilRice CES, generate the parents and corresponding hybrids. They are in close coordination with each other to facilitate sharing of germplasm for pollen parents, and other resources as needed. The outputs of the two projects are evaluated for major pest resistance by the crop protection experts (pathologist and entomologist) and for grain and eating quality traits by rice chemistry and food science experts, addressed by project HRP-005, which are conducted at PhilRice Los Baños, for TGMS-based breeding materials, and at PhilRice CES for CMS-based breeding materials. Research on seed and seed production for selected elite parents and hybrids are conducted both at PhilRice Los Baños and CES under project HRP-004 and HRP-007. The crop management component of HRP is externally-funded, and at this time is focused on nutrient management and field performance of elite hybrids under various growing environments. Strong coordination and feedbacking between and among projects are mandatory for proper and smooth flow of breeding materials, information exchange, knowledge generation, and technology development.

Development of CMS-based three-line hybrids

Joanne D. Caguiat

The HRP 002 aimed to develop three-line hybrid rice varieties and parent lines with good agro-morphological traits, high yield, acceptable grain and eating quality traits, and resistance to major pests and diseases. This project consisted of four interrelated studies to generate best performing three-line cytoplasmic male sterility (CMS)-based hybrids and parents.

For the development of maintainer lines, the S5N gene for wide compatibility was highly expressed in a germplasm Fancy where all the four testers expressed 100% except for IR36, which showed <70% spikelet fertility. Generated testcrosses from this entry will be further evaluated for sterility inducing gene next season. Three advanced maintainer lines (PR41325, PR4126, and PR41327) were confirmed to have bacterial leaf blight (BLB) resistance genes (Xa4 and xa5 or both). Confirmation of other Xa genes is in-progress. For CMS line development, pair crosses of PR15A and PR21A exhibited 100% or complete sterility. These CMS lines will be further seed increased for generation of pure core seeds.

For restorer line development, 11 lines were identified and selected as potential restorer lines with yield comparable and better than NSIC Rc 222, ≥ 80% spikelet fertility, with single or both Rf3, and Rf4 fertility restoring genes and passed the standards for grain quality evaluation. Two lines have resistant reaction against blast and BLB, while the rest have intermediate to resistant reaction to BLB under induced-method of screening. These selected potential restorer lines will be nominated to hybrid source nursery.

In 2020 dry season (DS), based on genotyping using molecular markers (Rf3, Rf4 and MNT) and pollen evaluation, 15 pollen parents were identified as potential maintainer lines (positive for MNT and with complete sterile pollen), unfortunately these entries were also positive for both Rf3 and Rf4. There were eight entries with both Rf3 and Rf4, 8 with Rf3, and 16 contained Rf4 identified as potential restorer lines based on pollen evaluation and genotyping results. Further confirmation and validation will be done. For combining ability result, among the testers, PR19A (set 1), IR79128A (set 2), and IR80156A (set 3) contained the highest GCA effects while IR73013-95-1-3-2R (set 1), PR34142-5-1-3-2R (set 2), and MATATAG 9 (set 3) showed highest GCA effects among pollen parents.

For evaluation of experimental hybrids in preliminary yield trial, four (14%) of 28 experimental hybrids were identified to have 7.7 (PR52525H) - 7.9t/ha yield (PR52524H) with 2-17% yield advantage over check varieties Mestiso 55 (6.71t/ha), Mestiso 32 (6.76t/ha), Mestiso 20 (7.50t/ha) and NSIC Rc 222 (7.26t/ha).

Four hybrids (PR52524H, PR52526H, PR52538H, PR52525H) showed 6-9% yield advantage over check NSIC Rc 222. Seed production and further evaluation will be conducted on these entries next season. Further characterization and use of parent lines to generate best performing experimental hybrids will be implemented. Majority of the activities in this study was restricted due to the COVID-19 pandemic.

For CMS line multiplication, 18 CMS lines were generated through plant to plant crossing, 17 AxB combinations were seed produced for nucleus seeds, and 8 AxB combinations were multiplied. For experimental hybrids, a total of 22 entries were seed produced to be used in preliminary yield trail, 4 entries for advance yield trial, and one for National Cooperative Testing. Ensuring the genetic purity of all parent lines and hybrids will be and should be the top priority. Thus, for the next season, proper and stringent monitoring and management will be employed.

Development of superior maintainer and male sterile lines

Imeldalyn G. Pacada, Abegail G. Pascua, Merryll Anne M. Miranda, Claudenicl A. Blacer, and Josielyn C. Bagarra

The development of diverse maintainer lines from different ecosystem and from other cultivar group will broaden the maintainer germplasm source. These maintainer lines when converted to selected cytoplasmic male sterile (CMS) lines will not only widen the parental source but also increase the CMS germplasm pool that may facilitate the breeding of heterotic F_1 hybrids.

For CMS conversion of maintainer line with *Xa* gene and exerted stigma, among the generated backcross population evaluated none of them showed 100% completely sterile (CS). This signifies that the CMS lines used were unable to inherit sterility; thus, sterility is not stable. It is also possible that the CMS lines used for conversion is not easily maintained. This reason might lead to limiting the conversion process of diverse genotypes into new CMS lines in the future.

For the development of maintainer line with S5n gene, among five javanica germaplasm, wide compatibility traits were highly expressed in Fancy, in which the four testers expressed 100% except for IR36. Only 3 of the 20 evaluated plants (85%) showed <70% spikelet fertility.

For obtaining purified CMS and maintainer lines, only PR15 and PR21 exhibited 100% CS to their evaluated pair crosses. However, stability of sterility of these two lines should be monitored to prevent fluctuation of CS plants. This can be done by producing at least two cycle of pair crosses (≥ 25 CMS/pair crosses) with 100% CS in all CMS plants evaluated.

Development of diverse restorer lines

Frodie P. Waing, Micah Abegail C. Meman , Jasmin II C. Santiago, Marie Stella F. Ablaza, Leonilo V. Gramaje, and Nenita V. Desamero

In hybrid rice seed production using three-line or CGMS (Cytoplasmic Genic Male sterility) system, the combination of a cytplasmic male sterile line, maintainer line and restorer line carrying the restorer gene (*Rf*) to restore the fertility are indispensable for the development of hybrids. However, one of the challenges for three-line system to be successful is the development of restorer line with good restoring ability coupled with other good agronomic factors. The study aimed to: (1) develop diverse restorer lines with 80-85% pollen and spikelet fertility, with acceptable grain quality and resistance to major biotic stresses, and (2) evaluate the performance of promising restorer lines for grain yield, and other important morpho-agronomic traits. In the pedigree nursery dry season evaluation 1,129 lines in F3-F5 generations in the field and 254 F1 plants in the screen house were established for selection and generation advancement. Based on PAcp, 672 F3-F4 lines were selected for generation advancement and all 18 F1 populations were forwarded to the next season. Field performance, grain quality, and reaction to major insect pests and diseases of advance breeding lines were evaluated. Thirty-seven potential breeding lines were identified with yield comparable and better than NSIC Rc 222 ranging from 4.82 to 7.26t/ha with an average of 6.56t/ha in wet season. Eleven (11) breeding lines were identified as potential restorer lines based on yield, with presence of *Rf genes,* with 80.20 to 90.83% spikelet fertility, and have passed the grain quality standards. Identified and selected potential restorer lines with desirable traits will be nominated to hybrid source nursery.

Development and field performance evaluation of experimental hybrids

Joanne D. Caguiat, Josielyn C. Bagarra, Frodie P. Waing, Micah Abegail C. Meman, John Paul Uera, Marie Stela F. Ablaza, and Nenita V. Desamero

The successful use of heterosis and identification of superior hybrid combinations depends on the combining ability of parent lines. The objectives of the study included: (1) evaluate the performance of experimental hybrids in the testcross nursery (TCN) based on fertility, sterility, and other important morpho-agronomic traits; (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. In 2020 dry season, based on genotyping using molecular markers (Rf3, Rf4 and MNT) and pollen evaluation, 15 pollen parents were identified as potential maintainer lines (positive for MNT and with complete sterile pollen). However, these entries were also positive for both Rf3 and Rf4. Eight entries with both Rf3 and Rf4, eight with Rf3, and 16 contained Rf4 were

identified as potential restorer lines based on pollen evaluation and genotyping results. Further confirmation will validate results. For combining ability, PR19A (set 1), IR79128A (set 2), and IR80156A (set 3) had the highest general combining ability (GCA) effects while IR73013-95-1-3-2R (set 1), PR34142-5-1-3-2R (set 2), and MATATAG 9 (set 3) showed highest GCA effects among pollen parents.

For preliminary yield trials, four (14%) of the 28 experimental hybrids were identified to have 7.7t/ha (PR52525H) - 7.9t/ha yield (PR52524H) with 2-17% yield advantage over check varieties Mestiso 55 (6.71t/ha), Mestiso 32 (6.76t/ha), Mestiso 20 (7.50t/ha) and NSIC Rc 222 (7.26t/ha). Four hybrids (PRPR52524H, PR52526H, PR52538H, PR52525H) showed 6-9% yield advantage over check NSIC Rc 222. Seed production and further evaluation will be done on these entries next season. Further characterization and use of parent lines to generate best performing experimental hybrids will be done. Majority of the activities in this study was restricted due to COVID-19 pandemic.

Seed multiplication of experimental hybrids and parent lines

Frodie P. Waing, Joanne D. Caguiat, Leonilo V. Gramaje, Monique V. Corpuz, Marie Stella F. Ablaza, and Nenita V. Desamero

Parents and experimental hybrids were seed produced to ensure the availability of sufficient amount of seeds to be used in every stage of trial (from observational nursery to NCT). It involves two steps: the multiplication of cytoplasmic male sterile (CMS) lines (A × B) and the production of F_1 seeds (A × R. This study aimed to: (1) produce sufficient amount of physically and genetically pure hybrid nucleus seeds of hybrid parent lines (A, B, and R); and (2) produce sufficient and genetically pure seeds of experimental hybrids for ON, preliminary yield trial (PYT), Advance Yield Trial (AYT). In CMS line multiplication, 18 CMS lines generated from plant to plant, 17 AxB combinations were seed produced for nucleus seeds, and 8 AxB combinations were multiplied for other experimental hybrids. For experimental hybrids, 22 entries were seed produced to be used in PYT and four entries for AYT. Seed increase of R-lines was done to all of the entries in different yield trials. It was noted that most of the entries had high seed reproducibility during the dry season therefore prioritization of entries to be seed produced will be given consideration. Seed production of parents and hybrids for wet season is effective if limited entries will be seed produced. Furthermore, maintaining the genetic purity of all the seed production plots should be the top priority in all seed production plots to produce good results in experimental trials.

PROJECT 2

Development of Thermo-sensitive genetic male sterile (TGMS)-based two-line hybrid rice

Mel Anthony T. Talavera

The Development of Thermo-sensitive Genetic Male Sterile (TGMS)-based Two-line Hybrid Rice project is composed of six interrelated studies. Three studies are devoted for line development of both female and male parents, two studies for generating new and promising experimental hybrids, and one study for field performance evaluation of new and promising experimental hybrids. The product of TGMS line development and pollen parent line development is used to generate new promising experimental hybrids. Untested F1s are tested in the Hybrid Observational Nursery (HON). Promising hybrids identified in HON underwent reconstruction of F1 seeds so that there will be sufficient seeds for hybrid preliminary yield trial (HPYT) and advance yield trial (AYT). Only the best performing hybrids will be nominated to the National Cooperative Test (NCT) for countrywide performance evaluation (Figure 1).

This year, the project focused on development of new TGMS and pollen parent lines, seed production of experimental hybrids, performance evaluation of new and promising experimental hybrids, and generation of F1 seed production protocol for AYT 191.

During the first half of the year, the project suffered setback due to implementation of Luzonwide lockdown beginning March. As a result, several nurseries and activities were postponed or cancelled. For the development of female parents, shuttling of ratooned breeding lines from male sterile environment (Los Baños) to male fertile environment (Benguet) was postponed. Selected ratooned breeding lines were transplanted in the screen house while waiting for the onset of Amihan in Laguna expected in November with its peak in February. In this period, MFE site in Laguna was utilized and fertility evaluation phase of TGMS was conducted. For development of male parents, lockdown resulted in reduced land area devoted to its activities. Some parts of experimental area used in developing male parent line is located inside IRRI, which during the year was inaccessible. As a result, the composite population for male development was not conducted. For generation of new and promising experimental hybrids, no hybrids were generated during the dry season (DS), which cancelled HON and HPYT performance trials in the 2020 wet season (WS). The evaluation of new and promising experimental hybrids was also affected by lockdown. Fertilization, data gathering, and crop protection were not conducted properly resulting in few or no data gathered. During 2020 WS, strong rain and wind brought by five typhoons that traversed the southern Luzon lodged the hybrids being evaluated in AYT trial while yield of F1 seed in the seed production plots was low.

PROJECT 2

For female development, the project handled two composite populations; for TGMS development, 20 large F2 population, 1,122 F2 populations from recurrent selection, 1728 segregating breeding lines from F3 to F6, and 92 ON lines. At male fertile environment (MFE), the project evaluated 2,475 plants (1,249 plants for hybridization method; 1,226 for recurrent selection method) coming from F2 to F6 generations for fertility restoration and seed increase. Note that the MFE site is exclusive for TGMS breeding only. All selection for 2020 DS and WS was shuttled in Majayjay in December. Fourteen (14) fixed lines for female line development were selected in TGON nursery during the 2020 DS. No characterization happened due to the pandemic. Seed increase was conducted in December in Majayjay, Laguna.

For male development, two pollen parents completed the evaluation for agronomic data, grain quality, and pest and disease resistance. RPP6 546 and 552 had plant height of at least 100cm, was medium maturing, had resistance against pests and diseases, was lodging tolerant, and with acceptable grain quality. These materials will be transferred to active collection of pollen parents for developing experimental hybrids. For the year, seven pollen parent lines were identified with good combining traits. These pollen parents have accumulated numerous cross combinations with elite TGMS lines to develop good performing experimental hybrids. These pollen parents were characterized as medium maturing, with plant height of about 100cm, and resistant against pests and diseases, and have intermediate amylose content (AC) and gelatinization temperature (GT) except for RPP6 -231, -119, and -112, which have high AC reading. Combining with the outputs in 2019, the project has identified 10 ideal pollen parents.

New lines developed in TGMS and pollen parent breeding will be included in the pool of parents for generation of new and promising experimental hybrids. During the year, 366 new and 104 promising experimental hybrids were generated using manual crossing and pollination, and modified isolation free method. These hybrids will be utilized as seeding material for HON, HPYT, and AYT during 2021 DS.

During the 2020 DS, only the first set of HON and two sets of HPYT had survived the three month-long lockdown caused by COVID-19 pandemic. Only yield data was collected from the surviving performance trial due to lack of manpower. Yield results showed that for HON, 34 hybrids of the 200 entries were identified better than the inbred and hybrid checks used. However, only 9 of the 34 can be seed produced in 2021 because of the failure to acquire seeds in UPLB RVIT due to Lockdown. For HPYT, out of 24 experimental hybrids evaluated, two hybrids were identified superior than the highest yielding hybrid check for yield. These hybrids also had shown resistance against major pests and diseases and possessing acceptable eating quality traits. HPYT 752 was identified in HPYT first set had grain yield of 7415kg/ha with yield advantage over highest yielding check M73 and NSIC Rc 222 of 9.4% and 25%, respectively. Based on chemical analysis of the milled rice sample, this hybrid had high AC and intermediate alkali spreading value (ASV) combination. This combination will result to moderately tender cooked rice texture. This is considered acceptable for majority of the Filipinos. The other

hybrid, HPYT 767 was identified in HPYT second set. This hybrid had grain yield of 7547kg/ha with yield advantage over M19 and NSIC Rc 222 of 14% and 27%, respectively. This hybrid had intermediate by intermediate combination of AC and ASV. Intermediate AC and ASV is the general description of preferred eating quality rice by most of the Filipinos. Both hybrids will be reconstructed during 2020 WS and will be retested in AYT in 2021.

The generation of seed production protocol for promising hybrid AYT 191 was completed. Agronomic characteristics of the parents of the new hybrid showed 30-34cm height advantage for culm length and plant height, respectively, of P-line over S-line even without GA_3 application. P1 should be sown four days earlier before S-line. Transplanting should be done 21 days after sowing while the replanting should be completed 5 days after transplanting. Crop care and maintenance should be strictly followed for proper flower synchronization of S and P-lines.

Development of new and diverse TGMS lines through hybridization and selection

Edelweiss E. Sajise, Kathleen C. Gonzales, and Mel Anthony T. Talavera

In this study, transfer of thermo-sensitive genetic male sterile (TGMS) trait into individuals of improved genetic background was done through hybridization and selection. Segregating generations were handled using pedigree system while evaluation of breeding materials and fixed lines was done using shuttle breeding method. In this method, sterility of TGMS breeding materials were evaluated at male sterile environment (MSE) while fertility was assessed and seed generation done at male fertile environment (MFE). For 2020, 20 F1s generated for TGMS line development were selected to advance to F2. There were 237 sterile plants in the F2 populations selected while 335 F3-F6 lines were ratooned for generation advance. Likewise, 159 fertile plant selections in the F2 were advanced to F3 for further segregation to select for sterile lines. To date, 43 promising TGMS lines will undergo further evaluation (stability of sterility/fertility expression, evaluation for pest and disease resistance and grain quality) and agro-morphological characterization this coming 2021. These lines will also be used in generating two-line experimental hybrids to check its combining ability with available pollen parents in the collection.

Extraction of stable and improved TGMS lines through recurrent selection

Edelweiss E. Sajise, Kathleen C. Gonzales, Bermenito Punzalan, and Mary Jane Vasquez

Continuous development of more diverse and improved thermo-sensitive genic male sterile (TGMS) lines is essential to generate better performing two-line hybrids. Recurrent selection as a breeding method concentrates on fewer individuals in the population desirable traits through recurrent cycles of intercrossing and selection. It allows intercrossing among individuals in the population to keep plants in heterozygous conditions allowing more chances of genetic recombination. This method involves the development of composite intercrossing population from which potential TGMS lines with stable sterility/fertility at male sterile environment (MSE) and male fertile environment (MFE), earliness and shorter stature, resistance to pests and diseases and good grain quality are selected. In 2020, two composite populations were maintained to allow extraction of segregating male sterile lines. From the TGMS populations established and evaluated in the 2020 pedigree, 321 F2 plants and 339 F3-F6 male sterile plants were selected. On the other hand, seven potential new TGMS lines were identified in the in the observation nursery. All selected S-lines were ratooned and allowed to set seeds in MFE site in Majayjay. The advanced TGMS-lines extracted from the recurrent populations will be subjected to further testing in the MSE and MFE, and for combining ability, grain equality and resistance to major insect pests and diseases.

Identification and development of pollen parents for two-line hybrids

Mel Anthony Talavera and Kathleen Gonzales

The study aimed to develop pollen parents that have strong fertility restoring ability in the F1 progeny, good general combining ability, good agronomic characteristics, resistance to pests and diseases and abiotic stresses and with good grain quality.

Breeding for pollen parent lines evaluated 315 populations, 663 lines from F3 – F6 generations, and 2 observational nursery (ON) lines. Selection resulted in the advancement of 40 F4 lines and 2 ON lines was conducted in the dry season, while pre-selection in F5 generation identified six F5 families for final selection at maturity was implemented in the wet season.

Eight pollen parents were identified as ideal pollen parents. These pollen parents had accumulated numerous cross combinations with elite thermo-sensitive genic male sterile (TGMS) lines to develop good performing experimental hybrids. These pollen parents were characterized as medium maturing, with plant height of about 100 cm, resistant against pests and diseases, and have intermediate amylose content and gelatinization temperature.

Development of two-line experimental hybrids

Kathleen Gonzales, Mel Anthony Talavera, and Edelweiss Sajise

Maintaining a substantial number of experimental hybrids for evaluation and testing ensures the higher chances of identifying good heterotic hybrids. To generate two-line experimental hybrids, promising thermo-sensitive genic male sterile (TGMS) lines and diverse pollen parents were assembled in a test cross nursery. Experimental F1 seed production was produced either through hand crossing or using isolation-free method. For this year, there are no experimental hybrids generated during dry season due to COVID-19 pandemic. In the wet season, 366 experimental hybrids were generated by hand crossing and isolation-free method. Developed hybrids composed the hybrid observational nursery HON for preliminary performance testing and evaluation.

Evaluation and field performance testing of promising two-line hybrids

Bermenito R. Punzalan, Mel Anthony Talavera, Mary Jane Vasquez, Kathleen Gonzales, Edelweiss Sajise, and Michelle Quimbo

For this year, one set of hybrid observational nursery and two sets of hybrid preliminary yield trial (HPYT) survived the effect of pandemic and calamity. Using yield data and grain quality analysis as main criteria in selecting best performing experimental hybrids, HPYT 752 and 767 were identified. These had grain yield of at least 7000kg/ha and yield advantage of at least 5% over the hybrid check and 15% over the inbred check. For grain quality, these hybrids passed the standard for cooking texture using chemical analysis. The F1 seed production and evaluation of these hybrids in advance yield trial will be conducted in the 2021 dry season and wet season, respectively.

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

Mel Anthony Talavera, Kathleen Gonzales, and Lowel Guittap

Thirty-six pollen parents and 28 female parents were assembled in crossing blocks, which were used to develop 104 promising experimental hybrids using isolation free method. These hybrids will be evaluated in the hybrid preliminary yield trial and advance yield trial during the 2021 DS. Hybrid in the pipeline AYT 191 y completed the F1 seed production protocol. Based on the guidelines, the female parent blooms four days later than the male parent; hence, should be seeded in advance. Potential yield of 3476kg/ha can be achieved through synchronization.

PROJECT 3

Hybrid seed and hybrid seed production research

Susan R. Berna

In this study, row ratio, planting distance and pollen load in relation to seed yield was determined. This will be the basis of the protocol to be developed for hybrid rice seed growers planting new hybrids once commercialized.

Two hybrid seed production trials, AxR and SXP of Mestiso 55 and Mestiso 73 were set up in both 2020 dry season and wet season using different row ratio and planting distance between A-line and S-line. For Mestiso 55, 2:6 and 2:12 row ratios were used with 10cm x 10cm and 20cm x 20cm planting distance between A-line rows. For Mestiso 73, six ratio ratios were tried but planting distance between S-lines was fixed at 20cm x 20cm. The study determined the effect of pollen load, row ratio, planting distance, and percent seed set on seed yield. In AxR of M55, pollen load was not measured owing to successive rains during pollination; however, significant yield difference was observed between the two row ratios used. Higher seed yield was observed in 2:6 than in 2:12. PRUPTG101, the female parent of Mestizo 73 opened at around 8:30am while SN578, male parent opened by 9am. The late opening of the male parent shortened flower synchrony by 30min. Peak of anthesis was observed between 10-11am. Cumulative average pollen load in SxP of Mestiso 73 was observed higher in S-line rows near the pollen source. Pollen load decreased towards the middle rows. Highest pollen grains were achieved from 10-11 am. Number of filled spikelets from plant 13 to plant 17 per S-line row per row ratio was highest in 3:12 and 2:12 row ratios with values of 1,051 and 1,036 respectively. However, percent seed set was highest in 3:10. Seed yield was observed highest in 2:8 and 3:8 with 855.14 and 825kg/ha, respectively.

With the increase demand for the F1 seeds, supply of public parental lines of these hybrids must be sustained. Furthermore, sufficient volume of buffer stock should be made available. However, the average seed yield per hectare in seed production was roughly below 2t/ha mainly because of low percentage seed set. It is therefore essential to establish the appropriate planting schedule on which the critical growth stage during panicle development that dictates sterility and fertility coincides with the required temperature regime. In this study, two sterile-lines (S-lines) of Mestiso 19 and Mestiso 20 were used. Experimental treatments were arranged in split plot RCBD with three replications. Planting date served as the main plot while various nitrogen (N), phosphorus (P), and potassium (K) treatments were used as subplots. Thermosensitive henic male sterile (TGMS) lines were planted on December 9, 2019, January 2020, and February 4, 2020. Results showed that average grain yield (GY) was low across three planting dates and NPK levels. The low grain yield can be attributed to low spikelet fertility, which was greatly affected by the increasing temperature and decreasing relative humidity on the critical stages of panicle initiation. Late December planting (P1) obtained the highest grain yield followed by P2 and P3. Yield decreased as planting schedule progressed. Significant GY yield difference was observed among planting dates but

no significant variation in response to different NPK treatments. For yield-related traits, plant height, number of filled grains, unfilled grains, panicle length, and leaf width showed significant variation in response to different planting dates while number of unfilled grains and leaf width showed significant variation in response to planting dates x treatment interaction. Among yield-related traits, spikelet sterility possibly contributed to the difference of GY in planting dates studied and was affected by varying temperature and RH levels on the critical stages.

Timing of planting coinciding with favorable climatic conditions coupled with appropriate management practices are important factors to consider in order to maximize grain yield of S-line parental seed production at male fertile environment in DSB, Negros Occidental.

Public hybrid parental lines of public hybrids produced by DA-PhilRice were tested for genetic purity using conventional grow-out test (GOT) before they are distributed for use by the hybrid seed growers and researchers. Only parental lines with 97% and higher genetic purity were distributed. The success of hybrid rice seed production depends on the quality of the hybrid parental lines. Parental lines and hybrid seed lots were produced in 2019 WS and 2020 DS. Those planted in GOT in 2020 DS and 2020 WS were evaluated for genetic purity. The genetic purity of hybrid parental lines and the hybrids were assessed based on observation of significant morphological characters: base color, plant height, leaf color, heading time and grain characteristics. Commonly observed off-types were recorded during field inspection.

In DS 2020 GOT, 33 of the 34 seed lots of parental lines produced in 2019 WS had genetic purity (GP greater than purity of 97%. Only one foundation seed lot of PRUPTG102 from Midsayap had <97% GP. Moreover, GP of 34 seed lots of public hybrids (F1) produced in 2019 WS was higher than 97%. Moreover, in 2020 WS GOT, 75% of parental lines produced in DS 2020 had higher than 97% GP. GOT results of TGMS hybrid showed that NSIC Rc204H produced in DS 2020 had >97% GP. Although the study showed some contamination in some seed lots of parental lines, overall GP was high.

Reliable results in the use of molecular marker in assessing the purity of the parental lines produced by DA-PhilRice and public hybrids produced by hybrid seed growers was done using 10 genotypes of breeder seeds of public hybrid parental lines. These genotypes were planted in 10 x 10 field matrix. Two weeks after transplanting, leaf samples from each genotype were collected in all plants per row and column for DNA extraction. Results showed that using three molecular markers (RM1, RM 127, RM511), only one molecular marker detected off-type in one parental line. The same leaf sample collection procedure was then used in assessing public hybrid parental lines used in commercialization and the hybrids produced by the hybrid seed growers. In 2020, parental lines of TGMS hybrid parental line of Mestiso 20 produced from Benguet, Midsayap, DSB, Negros Occidental, and Nueva Vizcaya were assayed and analyzed using microsatellite marker, RM1. Leaf samples used in DNA extraction were sampled in the GOT field.

In 2020 DS, 7 BS, 13 FS lots of PRUPTG102, and one FS lot of TG102M produced in 2019 WS were assayed using molecular markers. Five seed lots of breeder seeds of PRUPTG102 were pure. Average purity of FS of PRUP TG102 was 98.8%. However, lowest purity of 95.8% was observed in one seed lot produced in Kayapa, Nueva Vizcaya. The lone TG102M seed lot assayed using RM511 was also found pure. In 2020 WS, 10 FS lots of PRUPTG102 from two male fertile environments sites, Kayapa, Nueva Viscaya (KNV) and DSB, Negros Occidental and 2 seed lots of PRUPTG101 were analyzed using RM 1. Six seed lots from KNV have 98.4% purity. Four seed lots from DSB, Negros Occidental had 99.3% purity while the two seed lots of PRUPTG101 had 100% purity.

Moreover, GP of 34 seed lots of public hybrids (F1) produced in 2019 WS was higher than 97%.

Evaluation of flowering behavior and pollen dispersal in new hybrids in different locations, seasons, and time of the year

Kristel Mae A. Garcia, Monique V. Corpuz, and Susan R. Brena

Two hybrid seed production trials, AxR and SxP of Mestiso 55 and Mestiso 73 were set up in 2020 dry season and wet season using different row ratio and planting distance between A-line and S-line. For Mestiso 55, 2:6 and 2:12 row ratios were used with 10cm x 10cm and 20cm x 20cm planting distance between A-line rows. For Mestiso 73, six ratios were tried but planting distance between S-lines was fixed at 20cm x 20cm. The study determined the effect of pollen load, row ratio, planting distance, and percent seed set on seed yield. In AxR of M55, pollen load was not measured owing to successive rains during pollination but significant yield difference was observed between the two row ratios used. Higher seed yield was observed in 2:6 than in 2:12. PRUPTG101, the female parent of Mestizo 73 opened at around 8:30am while SN578, male parent opened by 9am. The late opening of the male parent gave less time for flower synchrony. Peak of anthesis was observed between 10-11am. Pollen load in SxP of Mestiso 73 was observed higher in S-line rows near the pollen source. Pollen load decreased towards the middle rows. Highest pollen grains were achieved from 10-11 am. Number of filled spikelets from plant 13 to plant 17 per S-line row per row ratio was highest in 3:12 and 2:12 row ratios with values 1,051 and 1,036 respectively. However, percent seed set was highest in 3:10. Seed yield was observed highest in 2:8 and 3:8 with 855.14kg/ha and 825kg/ha, respectively.

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

May Osano-Palanog (PhilRice-Negros) and Susan R. Brena (PhilRice CES)

The study established the appropriate planting schedule on which the critical growth stage during panicle development dictates sterility and fertility coinciding with the required temperature regime. In this study, sterile lines (S-lines) of Mestiso 19 and Mestiso 20 were used. Experimental treatments were arranged in split plot RCBD with three replications. Planting dates served as the main plot while treatments of various nitrogen (N), phosphorus (P), and potassium (K) levels were used as subplots. Results showed that average grain yield (GY) was low across the three planting dates and NPK levels. The low grain yield can be attributed to low spikelet fertility affected by increasing temperature and decreasing relative humidity on the critical stages of panicle initiation. In the three planting dates late December planting (P1) obtained the highest GY followed by P2 and P3. Yield decreased as planting schedule progressed. Significant GY yield difference was observed among planting dates but no significant variation in response to different NPK treatments. For yield-related traits, plant height, number of filled grains, unfilled grains, panicle length, and leaf width showed significant variation in response to different planting dates while number of unfilled grains and leaf width showed significant variation in response to planting dates x treatment interaction. Among yield-related traits, spikelet sterility possibly contributed to the difference of GY in planting dates studied and was affected by varying temperature and relative humidity levels on the critical stages.

Assessing the seed quality, purity and genetic identity of hybrid parental lines of public released hybrids produced at PhilRice

Jaec C. Santiago and Susan R. Brena

Genetic purity of public hybrid parental lines and public hybrids were assessed using grow-out test (GOT). In GOT, plants were grown up to maturity to identify off-types by assessing several morphological characteristics based on basal color, height, leaf color, heading period and grain characteristics that distinguish the genotypes. Each seed lot of parental line and hybrid were planted in the field following randomized complete block design with three replications. Thirty-four (34) seed lots of parental lines and 34 seed lots of public hybrids were assessed in 2020 DS

GOT. In 2020 WS, 10 seed lots of PRUPTG102, two seed lots of PRUPTG101, and 18 seed lots of thermosensitive genic male sterile (TGMS) hybrid, NSIC Rc 204H were assessed. Among the parental lines evaluated in 2020 dry season, FS seed lot of PRUPTG102 produced in the male fertile environment (MFE) in Mindanao by PhilRice Midsayap had the lowest genetic purity of <97% while one seed lot each of IR58025B and TG102M had 100% genetic purity. All other seed lots of parental lines had >97%. On the other hand, 32 seed lots of NSIC Rc 204H, one seed lot each of promising hybrid, PR47795H, and NSIC Rc 368H had >99% genetic purity. In 2020 wet season GOT evaluation, only three seed lots of PRUPTG102 produced in the MFE site in Kayapa, Nueva Vizcaya had <97% genetic purity while the other three seed lots from the same MFE site had >97% genetic purity. All FS seed lots of S-lines produced in Don Salvador Benedicto, Negros Occidental had >97% genetic purity. Moreover, all seed lots of TGMS hybrid, NSIC Rc204H had >98% genetic purity. For public hybrid parental lines, only genotypes with 97% and higher genetic purity after GOT are distributed to public hybrid seed growers.

Utilization of SSR markers for seed purity testing in TGMS hybrids of Mestiso 19 and Mestiso 20

Bermenito R. Punzalan, Kathleen Kaye S. Delos Angeles, and Susan R. Brena

Polymorphism in parental lines using molecular markers was examined using 10 genotypes. Seedlings of each genotype were planted in 10x10 matrix in the field. Two weeks after transplanting, leaf samples from each genotype were collected in all plants per row and column for DNA extraction. The same leaf sample collection procedure used on polymorphism was used in assessing public hybrid parental lines used in commercialization. In 2020, parental lines produced from Benguet, Midsayap, DSB, Negros Occidental, and Nueva Vizcaya were assayed and analyzed using microsatellite markers. Leaf samples used in DNA extraction were sampled in the grow-put test (GOT) field. Identification of off-types was based on markers RM 1 for S-line and RM 511 for P-line. In 2020 dry season, 7 BS, 13 FS lots of PRUPTG102, and one FS lot of TG102M produced in 2019 WS were assayed using molecular markers. Five seed lots of breeder seeds of PRUPTG102 were pure. Average purity of foundation seeds (FS) of PRUP TG102 was 98.8%. However, lowest purity of 95.8% was observed in one seed lot produced in Kayapa, Nueva Vizcaya. The lone TG102M seed lot assayed using RM511 was also found pure. In 2020 wet season, 10 FS lots of PRUPTG102 from two male fertile environment sites, Kayapa, Nueva Vizcaya (KNV) and DSB, Negros Occidental and two seed lots of PRUPTG101 were analyzed using RM 1. Six seed lots from KNV have 98.4% purity. Four seed lots from DSB, Negros Occidental had 99.3% purity while the two seed lots of PRUPTG101 had 100% purity.

PROJECT 4

Screening of CMS and TGMS parentals, breeding lines and promising hybrids for grain quality and resistance to major insect pests and diseases

Genaro S. Rillon/ Edelweiss E. Sajise

Early screening results in efficient breeding because materials with poor grain quality and susceptibility to major pests are discarded in the early stages of breeding. Thus, farmers are assured of good public hybrids that passed the National Cooperative Test. The project evaluated cytoplasmic male sterile (CMS) and thermo-sensitive genic male sterile (TGMS) parentals and promising hybrids for grain quality, and resistance to major pests. To facilitate efficient evaluation of entries, the project is divided into two groups; CMS-based entries were evaluated in CES, while TGMS entries were handled by PhilRice LB and UPLB.

For the evaluation of CMS parentals, breeding lines and promising hybrids, 53 usable CMS-based parentals (B and R lines) were evaluated for complete grain and eating quality attributes, 173 CMS-based breeding materials and F1 were screened for milling potentials, physical attributes and physicochemical properties (amylose content [AC] - gelatinization temperature [GT]) while 749 CMS parent lines were scored for AC-GT in 2020. For the traits considered, 15 entries in the CMS breeding nurseries were identified to have good to excellent grain quality. There were 277 lines in the CMS-based breeding nurseries and promising hybrids evaluated for resistance to major insect pests and diseases in four PhilRice Stations using the induced and modified field evaluation method. For this year, 107 CMS parental lines expressed resistance to pests and diseases in different experimental sites in the two seasons of test. These parental hybrid lines showed the greatest number of resistance to pests and diseases across sites. CMS breeding materials with combined good grain and eating quality and resistance to major insect pest and diseases will be identified once data from the 2020 dry season (DS) grain quality (GQ) analysis is completed.

For the screening of TGMS breeding materials, 573 entries were evaluated for physicochemical properties (AC, GT), milling potential, and physical attributes. Of the entries tested, nine lines were identified with good milling potentials and with good eating quality having intermediate AC-intermediate/high intermediate GT based on AC-GT combination. Reactions of TGMS parentals (TGMS or S-line and pollen parents or P-lines) to major pests and diseases were evaluated using the induced method. The 193 hybrid parent materials under the insect screening trial were evaluated for their resistance to greenhouse cultures of the green leafhopper (GLH) and brown planthopper (BPH) and field populations of stem borers. It was

observed that 88 and 30 entries were resistant to GLH and BPH, respectively. On the other hand, 196 TGMS breeding materials were evaluated for their reactions to major rice diseases. Evaluation results under the induced method showed one and nine entries were resistant to rice blast pathogen during the 2020 DS and wet season trial, respectively. Likewise, all parental pedigree nurseries and hybrid trials were evaluated for the reactions to major insect pests and diseases under field field conditions.

Data collected for evaluation for grain quality and major insect pests and diseases were submitted to the breeding group to aid in the selection and characterization of the parentals and advance lines.

Screening of CMS parentals, breeding lines and promising hybrids for grain quality

Evelyn H. Bandonill, Jay Carl A. Cacerez, Lynnden C. Castillo, Oliver C. Soco, Victor M. Mata, Frodie P. Waing, and Joanne D. Caguiat

Increased availability of cytoplasmic male sterile (CMS) parentals, breeding lines, and hybrids can be achieved through early grain quality screening aside from pest and disease resistance screening. This can significantly contribute to the fast turnaround of results by providing the data to the breeders earlier for their use before the next planting season. To identify CMS parentals, breeding lines, and promising hybrids with acceptable grain quality, 166 usable, advanced CMS-based parental lines, and F1 hybrids, 53 usable and advanced CMS-based parentals, and 433 advanced CMS-based parental lines from the 2019 wet season (WS) were evaluated. Meanwhile, 316 entries from the 2020 dry season (DS) are yet to be submitted, which will be composed of 8 P lines, 5 CMS, 1 maintainer, and 302 restorer lines to determine amylose content (AC) and analyze gelatinization temperature (GT). Seven restorer lines were also evaluated for complete grain quality. Out of the 166 usable, advanced CMS-based parental lines, and F1 hybrids, 37%, 27%, and 57% passed the standards for milling, physical, and physicochemical properties, respectively. Four maintainer, 6 restorer, and 1 elite line were identified useful in the breeding program once combined with the yield performance and pest and disease resistance. For the 53 usable and advanced CMS-based parentals, 53% of the entries had good milling potentials while 72% had acceptable AC-GT combination (L-L, L-I, I-I/HI, I-L). Among the 433 advanced CMS-based parental lines, majority (263 entries) had low, 160 had intermediate/high-intermediate, and 9 entries had high GT. Identification of promising lines will be completed once all the other pending analyses are completed.

Grain quality evaluation of TGMS parentals, breeding lines and promising hybrids

Asha Kamille M. Bagunu, Angelina dR. Felix, Edelweiss E. Sajise, and Mel Anthony T. Talavera

A more efficient breeding program requires early screening for grain quality. The study evaluated the grain quality of thermo-sensitive genic male sterile (TGMS) parentals, breeding lines, and promising hybrids following the National Cooperative Test method of grain quality evaluation. In 2020, 573 entries (200 from 2019 wet season harvest and 373 from 2020 dry season) were evaluated for milling potential, physical, and physicochemical attributes. There were 46 entries identified with good milling quality as indicated by their Pr to G1 classification on %HR and %TMR. From this, nine entries with good milling quality were also identified with good grain quality having intermediate amylose content (AC) - intermediate/high intermediate gelatinization temperature (GT) based on AC-GT combination. In terms of physicochemical parameters, 50.8% had high AC while 40.5% had intermediate AC. Only 7.4% had low and 1.2% had very low AC. Majority (90.7%) also had intermediate GT and the rest had low GT. Based on the AC and GT combination, majority (91.4%) of the samples belong to Cluster 1 (41.3%) and Cluster 2 (50.0%), predicted to have soft and moderately tender cooked rice texture. Only 7.3% belong to Cluster 3: hard cooked rice texture. Meanwhile, 20% (10 entries) analyzed for % chalky grains had G2 to G3 class for %chalkiness, while the rest had “aa” classification. The parentals and breeding lines evaluated that passed the recommendations on the various grain quality parameters will most likely be used by the breeders and advance in the breeding program.

Evaluation of CMS parentals, breeding lines and promising hybrids for resistance to major insect pests and diseases

Salvacion E. Santiago, Genaro S. Rillon, Juliet P. Rillon, Frodie P. Waing, Gracia B. Amar, Cherryl U. Seville, Keith Marielle B. Guarin, Cesjoy Carl B. Encarnacion, Zarah Faith T. Lunag, and Ellie Zandrew S. Ganella

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, promising hybrid parent lines were evaluated for resistance to major rice diseases such as blast, bacterial leaf blight (BLB), sheath

blight (ShB), tungro and major rice insect pests like stem borer damage (SB) (deadheart and whitehead), green leafhopper (GLH), and brown planthopper (BPH) during the 2020 dry (DS) and wet seasons (WS). All hybrid parent lines forwarded for evaluation for resistance to insect pests and diseases were tested in three experimental sites during the 2020 DS and WS in PhilRice CES, PhilRice Isabela, and PhilRice Negros. Out of 227 hybrid parent lines evaluated to insect pests and diseases during the DS, 49 CMS parental lines (29 restorer and 20 maintainer) were found to have intermediate reactions to blast, BLB, and SB (whitehead) across sites. Among the 49 hybrid parent lines, 42 of them (22 restorer and 27 maintainer) had 2-3 resistances to insect pests and diseases. Moreover, five restorer lines were also found to have intermediate resistance to blast, BLB, sheath blight, and stem borer while two restorer lines were found resistant. There were 150 cytoplasmic male sterile (CMS) parent lines evaluated for pests and diseases during the WS. Selected 55 R- lines had intermediate to resistant against blast, BLB, and stem borer damage (whitehead) across sites. Out of the 55 hybrid parent lines selected, 32 of them consistently had three intermediate to resistant reactions to blast, BLB, and stem borer damage (whitehead), 22 of them had 4 intermediate to resistant reactions and one R- line was found resistant to blast, BLB, and stem borer damage (whitehead) across sites. Evaluation of resistance against stem borer damage was also conducted in PhilRice CES. During the DS, resistance to whitehead was noted in 144 hybrid lines, in which 54 hybrid lines had intermediate reactions while the 29 lines were susceptible to damage. Resistance to whitehead was recorded in 142 hybrid lines in the WS. Five restorer lines had intermediate reaction to damage in PhilRice CES. None of the hybrid entries were resistant to BPH while intermediate reactions to damage were noted in 28 restorer lines.

Identification and characterization of hybrid breeding materials with resistance to major insect pests

Ester A. Magsino, Via Z. Cabuyao, and Reyniel F. Lopez

This study identified thermo-sensitive genic male sterile (TGMS) lines, pollen parents, and TGMS-based experimental hybrids that are resistant to major insect pests. There were 193 PS and TGMS materials under the insect screening trial evaluated for resistance to greenhouse cultures of the green leafhopper (GLH) and brown planthopper (BPH) and field populations of stem borers during the dry and wet seasons of 2020. Eight-eight (88) and 30 entries were noted to be resistant to GLH and BPH, respectively.

For the nurseries under the agronomic and yield trial, 2,365 entries were screened against field populations of stem borers.

In majority of the nurseries for both the nurseries under the insect screening and agronomic and yield trial, stem borer damage did not reach the evaluation validity thresholds due to low pest population except for TG_6 and RTG_4.

Data collected will be submitted to the breeding group to aid in the selection and characterization of the parentals and advance lines.

Evaluation of TGMS parentals, breeding lines, and promising hybrids for major diseases

Bernard O. Budot, Dara Faye R. Rivera, and Gilbert M. Diamante

This study evaluated thermo-sensitive genic male sterile (TGMS) parental lines and promising hybrids with resistance to major rice diseases. A total of 196 entries (51 entries in 2020 dry season [DS], 145 entries in 2020 wet season [WS]) consisting of TGMS parentals, breeding lines, and promising hybrids were evaluated for their reaction to blast (B), sheath blight (ShB), bacterial leaf blight (BLB), and rice tungro (RT) under the induced method. Additional 1,874 entries during the 2020 WS were also evaluated under natural infection in the field.

Evaluation results under the induced method showed 1 (RPP7 25) and 9 (RPP4-1956, RPP4-2027, RPP4-2031, RPP4-2105, RPP6 546, RFB 21B, GL78, GMS 11-8, KOR 63) entries that were resistant to blast pathogen during the 2020 DS and WS trial, respectively.

Data obtained for ShB and BLB during the 2020 WS showed susceptible reactions to majority of samples tested. For RT, all entries evaluated were susceptible. In natural infection, majority of the entries evaluated showed resistant reaction to ShB, BLB, brown spot, and sheath rot in 2020 WS . However, for RT and bacterial leaf streak, majority of the entries were intermediate.

PROJECT 5

Hybrid nucleus and breeder seed production research and maintenance

Lowel V. Guittap

The project aimed to produce, supply and maintain basic seeds of public released hybrids in support of the hybrid rice commercialization program, breeding activities, and hybrid seed related research. For several years, the project has supplied the required breeder seeds to meet the national hybrid cultivation target. Initial characterization and evaluation of seed reproducibility of promising hybrid parental lines and F1 seeds were also performed as part of the studies. Through the project, the basic seeds of public released hybrids are maintained for research.

The activities included purification, nucleus and breeder seed production, and distribution of breeder seeds to supply the foundation seed requirements of the commercialization project. The purification of Mestizo 1 (M1) started with the generation of paired crosses. There were 1,000 IR58025A plants evaluated during the dry season, in which 383 paired crosses were generated. The nucleus seed production of M1 parental lines was established in 2020 dry season (DS). However, the set-up was cancelled due to quarantine restrictions. The project, however, has enough stock of IR58025A and B nucleus seed to supply the requirement of the commercialization program. For PRUP TG102, no nucleus seed was produced during the year due to travel limitations. Breeder seed production in Los Baños of IR58025A x B, IR34686R, and TG102M was also halted given the pandemic situation in the region during the DS. In wet season (WS), breeder seed of parental lines of Mestizo 1 and P-line of Mestiso were produced. However, due to the series of typhoons that devastated the region from October 20 to November 10, the breeder seeds were discarded due to lodging and seed quality issues. There were 315 A/S line and 55 kg R/P breeder seed of M1 and Mestiso 20 dispatched to PhilRice Isabela, Midsayap, and Negros. As of November 5, 1,035kg IR58025A (with 528kg B-line) and 300kg PRUP TG102 have been stored and are available for foundation seed production upon request. Available IR34686R and TG102M breeder seeds are 305kg and 475kg, respectively. The seeds are stored at the PhilRice Los Baños cold storage.

As for the seed production research activities, five promising hybrids (three cytoplasmic male sterile [CMS] and two thermo-sensitive genic male sterile [TGMS]) were characterized and evaluated for basic and F1 seed production capacity. The parental lines of PR47779H, PR48800, PR47995H, AYT 191, and AYT 189 were characterized during the year. The plant height of PR29A was only 59.6cm, which affected PR47779H. Field operations such as artificial pollination affected the result. For the parental lines of PR47795H, a difference of 29 days in the DTH between IR80559A (82 days) and IR80559B (111 days) was observed. PR47779H and PR47795H had seed purity-related problems. For TGMS hybrids, AYT 189 and AYT 191 were evaluated. In the 2020 WS, SxP F1 seed of AYT 191 was produced.

An actual yield of 754kg/ha was obtained in a 0.5ha area. The yield is relatively average given the series of typhoons that brought strong winds and a high amount of rainfall from the flowering until maturity phase. SxP registered a crop cut yield of 3,111kg/ha. A seed production protocol for the F1 seed production of AYT 191 was also drafted.

The project ensured the availability of parental lines of public released hybrids. Thirty (30) genotypes were included in the maintenance activities. These genotypes are the parental lines of 20 public released hybrids. The project maintained 5kg of parental lines for each of the 20 public hybrids, which were made available to breeders and researchers upon request. This accomplishment is one of the main outputs of the program.

Hybrid nucleus and breeder seed production

Lowel V. Guittap, Wendy B. Abonitalla, Susan R. Brena, and Edelweiss E. Sajise

The main objective of the study was to supply the required amount of breeder seed of public hybrid parental lines of Mestizo 1 (PSB Rc72H or M1) and Mestiso 20 (NSIC Rc204H or M20) to meet the national hybrid target. The activities included purification, nucleus and breeder seed production, and distribution of breeder seeds. The purification of M1 started with the generation of paired crosses. There were 1,000 IR58025A plants evaluated during the dry season (DS), in which 383 paired crosses were generated. The processing of the crosses is on-going. The nucleus of M1 parental lines was established in 2020 DS. However, set-up was cancelled due to the quarantine restrictions. The project, however, has enough stock of IR58025A and B nucleus seed to supply the requirement of the commercialization program. For PRUP TG102, no nucleus seed was produced during the year due to travel limitations. Breeder seed production in Los Baños of IR58025 AxB, IR34686R, and TG102M was also halted due to the region's DS. Few PRUP TG102 breeder seeds were harvested in Benguet in May 2020, which were stored by the farmer-cooperator. In wet season, breeder seed of parental lines of M1 and P-line of Mestiso were also produced. However, due to the series of typhoons that devastated the region from October 20 to November 10, the breeder seeds were discarded due to lodging and seed quality issues. There were 315 A/S line and 55kg R/P breeder seed of M1 and M20 dispatched in PhilRice Isabela, Midsayap, and Negros. As of November 5, 1,035kg IR58025A (with 528kg B-line) and 300kg PRUP TG102 were stored and are available for foundation seed production upon request. IR34686R and TG102M breeder seeds are available in 305kg and 475kg, respectively. The seeds are stored at the PhilRice Los Baños cold storage.

Characterization of promising hybrid parental lines

Lowel V. Guittap, Wendy B. Abonitalla, Mel Anthony Talavera, and Leonilo Gramaje

The study characterized promising hybrid parental lines. Important characteristics of parental lines and seed reproducibility of basic and F1 hybrid seed production were determined. The parental lines of CMS-based promising PR40640H (PR29A, PR29B, and 19R56) and PR46838H (IR80559A, IR80559B, and PR34302R) were evaluated from 2018 to 2019. Characterization of the parental lines for important agro-morphological characteristics was conducted to determine the synchronization of AxB and AxR seed production. Based on the information gathered for the promising hybrids, the promising hybrids were recommended to be parked due to seed purity issues. It was decided that starting 2020, new promising hybrids will be evaluated by the project namely: PR47779H, PR48800, and PR47995H. PR29A registered a plant height of 59.6cm, which affected PR47779H. This can be attributed by field operations such as artificial pollination. For the parental lines of PR47795H, a difference of 29 days in the DTH between IR80559A (82 days) and IR80559B (111 days) was observed. Component lines of PR47779H and PR47795H also had seed purity-related problems. For the TGMS-based hybrids, two promising thermo-sensitive genic male sterility (TGMS)-based hybrids — PRUP 11 and PRUP 13 were evaluated from 2018 to 2019). In 2019, PRUP 11 was approved as Mestiso 103 by National Cooperative Test. On the other hand, PRUP 13 was later replaced due to seed reproducibility issues. AYT 189 and AYT 191 were also evaluated. In the 2020 wet season, SxP F1 seed of AYT 191 was produced. An actual yield of 754kg/ha was obtained in a 0.5ha area. The yield is relatively average given the series of typhoon that brought strong winds and a high amount of rainfall during the flowering to maturity phase. SxP obtained a crop cut yield of 3,111kg/ha. A seed production protocol for the F1 seed production of AYT 191 was also drafted.

Fertility/Sterility stability evaluation of TGMS and CMS parents of promising hybrids

Wendy B. Abonitalla, Lowel V. Guittap, Mel Anthony T. Talavera, and Leonilo V. Gramaje

Stability for female parents of promising hybrids was partly evaluated. Female parents of promising hybrids used in the study were the following: PR29A (PR40640H), IR80559A (PR46838H), IR79128A (PR47216H), and PRUP TG102 (PRUP 13). Evaluation for the stability of promising cytoplasmic male sterile-lines

PR29A and IR80559A started in 2018 wet season, while evaluation for the PRUP TG102 (PRUP 13) and IR79128A (PR47216H) started in 2019 WS and 2020 WS, respectively. For PR29A, seed set from the selected 81 completely sterile (CS), 29 sterile (S), and 45 partially sterile (PS) plants were planted during 2019 dry season. During the evaluation, 44 of the 81 completely sterile plants had seed sets. Also, 12 of 29 sterile plants and 21 of 45 partially sterile plants had seed sets. However, activities for this CMS-line were discontinued due to the reported issue on the purity of the seed samples. IR80559A also had similar reported case. Evaluation for IR80559A is still ongoing. For the monthly planting of PRUP TG102 from June 2018 to August 2019 in Los Baños, initial results showed that the highest percentage of seed set and pollen fertility were observed in S-line plants planted in December. Seed set was also observed in S-line plants established in October and January. S-line of AYT 191 was planted every month. Blooming habits such as time and duration of anthesis and 50% days to heading were also recorded. Agro-morphological characteristics such as plant height, tiller number, and panicle length were also recorded.

Basic seed maintenance of public hybrid parentals

Wendy B. Abonitalla, Lowel V. Guittap, and Edelweiss E. Sajise

Maintenance of basic seeds is essential to provide easy access when needed for any research-related activities. Safekeeping of seed files of seed lots is also important that serves as future reference. The study maintained basic seeds of released public hybrids for safekeeping and for research-related purposes. Twenty (20) released public hybrid varieties were maintained at Los Baños. At least 5kg each of 30 parental lines were maintained for the program's research activities. Various seed lots of public hybrid parental lines were processed and stored for maintenance in the cold room at the station with temperature of 18-20 ^{O}C and 40-60% relative humidity. In 2020 (January to November), 30 parents of 20 released public hybrid varieties were processed and maintained. The 20 public hybrid varieties included 15 CMS- and 5 TGMS-based varieties. Likewise, 95.1kg of 13 parental lines were distributed to researchers in support of research activities. Thirteen (13) parental lines of public released hybrids were requested and served during the season. Seed dormancy period of 10 parental lines of identified pre-commercial and commercial hybrids varieties was also determined, which is useful in seed production. This information will be essential especially in seed certification and distribution activities.