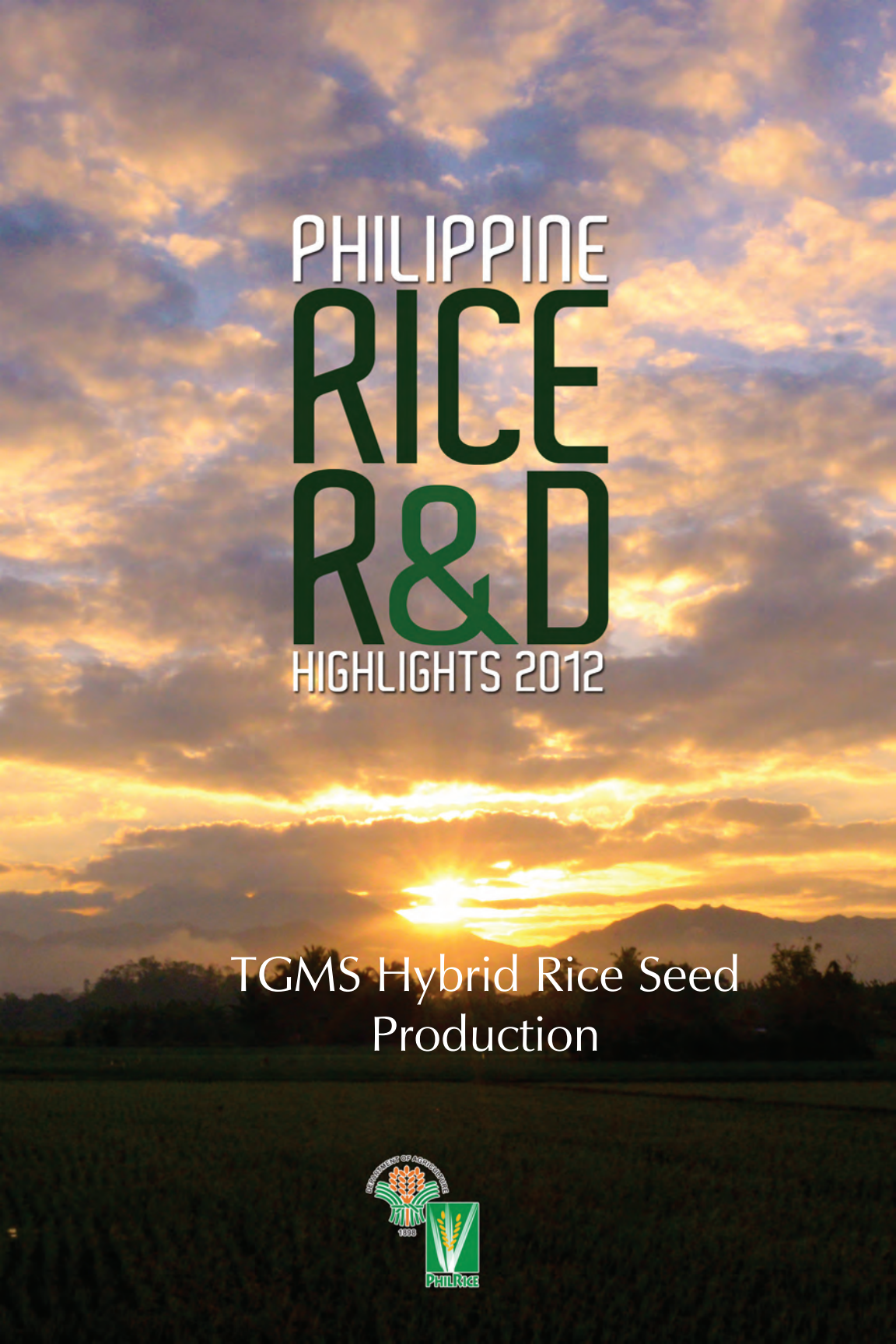
PHILIPPINE RICE R&D HIGHLIGHTS 2012



TGMS Hybrid Rice Seed Production

TABLE OF CONTENTS

TGMS Hybrid Rice Seed Production

Project Leader: Susan R. Brena

Aside from cytoplasmic male sterile system, seed growers can also use the thermogenetic-male sterile (TGMS) system to produce F1 hybrids. The latter is simpler but is highly dependent on temperature, particularly the S–line multiplication and the SxP seed production. The TGMS hybrid rice seed production project was approved for implementation in December 2011. To achieve the the project objectives, seed production, and seed certification trainings should be conducted for all stakeholders to be involved in the activities of the project. In the HRCP project implemented in the early 2000, many AxR hybrid seed growers were trained but not all of them may engage in TGMS seed production. Most of them are from the northern part of Luzon where long cold spell is experienced during dry season (DS) cropping unlike in Mindanao with encouraging seed yield based on previous trials.

In the multiplication of parental lines, the S–lines or the female parent are multiplied in the male fertile environment (MFE) or in areas with at least 700-m elevation. The S–lines are planted from December to January to capture the low temperature that should fall during panicle development. The S–lines produced in MFE sites will be used in the F1 seed production in the male sterile environment (MSE). In MSE, the temperature during stages II to IV of panicle development should not be lower than 230C, otherwise selfing will occur. Based on previous trials of SxP seed production, ideal sites are areas in Mindanao and Visayas.

Highlights:

- Three TGMS seed production and seed certification trainings were conducted, sponsored by the DA-RFUs 11 and 12. Most of the participants are AxR seed growers. After the training, these seed growers became accredited TGMS seed growers.

- Out of 15,570 kg S–lines produced in 2012, only 9,740 kg were used for planting. S–lines for distribution to seed

growers should have 97.5% purity. All P –lines produced have 100% purity.

- TGMS F1 hybrids produced in 2012 DS used S–lines produced in 2011.

- Actual area covered by SxP seed production was 64.5 ha for both Mestiso 19 and 20, exceeding the target of 30ha for 2012 DS. Total production reached 36,018kg Mestiso 19 (2,001 bags) and 8,686kg Mestiso 20 (482 bags). SxP seed production at PhilRice CMU during the 2012 DS was not possible due to the selfing observed.

- From the 2012 DS production, 1,279 bags M19 and 347 bags M20 were distributed but only 1,073 bags of M19 and 268 bags M20 were actually planted in 2012 WS.

- In 2012 WS, total SxP seed production areas for M19 and M20 were 219.7 and 12ha, respectively. The total yield obtained amounted to 151,325kg (8,406 bags) M19 and 6,678kg (371 bags) M20. Bulk of the TGMS hybrids produced came from hybrid seed growers. Seed growers observed susceptibility of the S–lines to kresek (BLB at the seedling stage). This has been one of the most severe problems encountered which accounted for the low seed yield obtained in the seed growers' field.

- SxP seed production at PhilRice Midsayap resulted in very low seed yield due to high occurrence of stemborer.

- For 2013 DS, 6,026 bags M19 and 244 bags M20 were distributed for planting while the remaining seeds will be used as seed stock for early planters for 2013 WS cropping.

- Results of hybrid techno–demo in 2012 DS and WS showed that both M19 and M20 have the potential to give high yield. However, the performance evaluation made on Mestiso 19 in Ormoc City showed that the yield

obtained in the farmers' field is dependent on the level of inputs applied.

Table 1. TGMS trainings conducted in 2012

Date Conducted	Venue	Category of Participants	Number of Participants
April 10 – 14	PCU, Tagum	Seed growers, Seed Inspectors	19
April 16 - 20	PCU, Tagum	Seed growers and PhilRice staff	14
May 28 – June 1	Dolores Resort, Lake Sebu	Seed Growers, ATI, and RFU staff	16

Table 2. Parental Seed Production (Foundation seed)

Station	Total area Planted (ha)	Production/ Season (kg)		Total Production (kg)	Purity (%)
		DS	WS		
S-line					
PhilRice LB	4.0	6,240	800	7,040	99.3
PhilRice CMU	2.3	1,300	-	1,300	93.9
PhilRice Negros	2.0	900	1,800	2,700	99.2
PhilRice Isabela	2.0	4,530		4,530	93.3
TOTAL				15,570	
P-line					
PhilRice LB	3.0	6,000			100.0

Table 3. Parental Lines distributed in 2012.

Parental line	Volume distributed (kg)	
	2012 WS	2013 DS
S-line	3,892	2,865
P-line	1,297	1,820

Table 4. SxP seed production in 2012 DS.

SxP sites	Area planted (ha)		Total production (kg)	
	Mestiso 19	Mestiso 20	Mestiso 19	Mestiso 20
PhilRice-Negros	11	5	5,328	3,366
PhilRice -Agusan	1			
PhilRice -CMU	5		rejected	
Banay-banay, Davao Oriental	31.3	3	26,478	5,310
Magsaysay, Davao del Sur	1		1,116	
Surallah, South Cotabato	2		1,296	
Salvacion, Davao del Norte	1		1,296	
RIARC, San Jorge, Samar	2			
Kananga, Leyte	2		504	
TOTAL	56.5	8	36,018 or 2,001 bags	8,676 or 482 bags

Note: 1 bag = 18 kg

Table 5. S x P seed production sites in WS 2012.

SxP sites	Area planted (ha)		Total production (kg)	
	Mestiso 19	Mestiso 20	Mestiso 19	Mestiso 20
PhilRice-Negros	12	12	4,409	6,678
PhilRice-Midsayap	23		2,664	
Davao Oriental	158		128,610	
Davao del Norte	5.7		7,056	
Davao del Sur	6		2,178	
Surallah, South Cotabato	13		6,210	
Kananga, Leyte	2		198	
TOTAL	219.7	12	151,325 or 8,406 bags	6,678 or 371 bags

Table 6. TGMS F1 hybrids produced in 2012 DS delivered for WS 2012 cropping.

Delivery Site	Total number of bags delivered		Actual number of bags planted	
	Mestiso 19	Mestiso 20	Mestiso 19	Mestiso 20
Zamboanga	100	100	63	71
APC,Bohol	25	20	25	20
Ormoc	200		156	
Tacloban	330		330	
Butuan	100	25	100	25
Iloilo		52		52
Kananga, Leyte	200		200	
PhilRice - CES	324	150	199	100
TOTAL	**1,279**	**347**	**1,073**	**268**

Table 7. Results of F1 TGMS hybrid techno–demo in 2012 DS.

Cooperator	Farm Site	Yield (t/ha)	
		Mestiso 19	Mestiso 20
Rizal Corales	Bagong Sikat, Munoz NE		9.4
Ms. Francisco	San Antonio, Nueva Ecija	7.9	
Paul Antonio	Cabanatuan, NE	7.4	
Jerry Garcia	Victoria, Tarlac		7.6
Allan Sagun	Maligaya, Munoz, NE	8.01	7.06

Table 8. Results of F1 TGMS hybrid techno–demo in 2012 WS.

Cooperator	Farm Site	Yield (t/ha)	
		Mestiso 19	Mestiso 20
Francisco Cerdana	Lambayong, Sultan Kudarat	7.13	
Francisco Cerdana	Lambayong, Sultan Kudarat	7.44	
Melba Garcia	Narra, Palawan		6.86
Mr. Baniqued	Molave, Zamboanga		9.45
Iwahig Penal Colony	Puerto Princesa	6.5	7.2

Table 9. Performance evaluation of M19 in Ormoc City in WS 2012.

Farmer Cooperator	Farm Site	Area Planted	Total Production (t/ha)	Fertilizer Rate Applied
Vicenta Roldan	Matica-a, Ormoc	1	5.66	67-7-7
Ana Judilla	San Jose, Ormoc	1	6.58	55-7-7
Alfredo Baguion	Matica-a, Ormoc	1	4.83	67-7-7
Veronica Cadiano	Matica-a, Ormoc	1	4.25	28-7-7
Danilo Ceniza	Kadaohan, Ormoc	1	3.84	37-7-7
Rodrigo Corro	Matica-a, Ormoc	1	3.84	30-7-7
Buenaventura Dumidapat	Matica-a, Ormoc	1	3.81	30-7-7

Abbreviations and acronymns

ABA – Abscicic acid
Ac – anther culture
AC – amylose content
AESA – Agro-ecosystems Analysis
AEW – agricultural extension workers
AG – anaerobic germination
AIS – Agricultural Information System
ANOVA – analysis of variance
AON – advance observation nursery
AT – agricultural technologist
AYT – advanced yield trial
BCA – biological control agent
BLB – bacterial leaf blight
BLS – bacterial leaf streak
BPH – brown planthopper
Bo - boron
BR – brown rice
BSWM – Bureau of Soils and Water Management
Ca - Calcium
CARP – Comprehensive Agrarian Reform Program
cav – cavan, usually 50 kg
CBFM – community-based forestry management
CLSU – Central Luzon State University
cm – centimeter
CMS – cystoplasmic male sterile
CP – protein content
CRH – carbonized rice hull
CTRHC – continuous-type rice hull carbonizer
CT – conventional tillage
Cu – copper
DA – Department of Agriculture
DA-RFU – Department of Agriculture-Regional Field Units
DAE – days after emergence
DAS – days after seeding
DAT – days after transplanting
DBMS – database management system
DDTK – disease diagnostic tool kit
DENR – Department of Environment and Natural Resources
DH L– double haploid lines
DRR – drought recovery rate
DS – dry season
DSA - diversity and stress adaptation
DSR – direct seeded rice
DUST – distinctness, uniformity and stability trial
DWSR – direct wet-seeded rice
EGS – early generation screening
EH – early heading
EMBI – effective microorganism-based inoculant
EPI – early panicle initiation
ET – early tillering
FAO – Food and Agriculture Organization
Fe – Iron
FFA – free fatty acid
FFP – farmer's fertilizer practice
FFS – farmers' field school
FGD – focus group discussion
FI – farmer innovator
FSSP – Food Staples Self-sufficiency Plan
g – gram
GAS – golden apple snail
GC – gel consistency
GIS – geographic information system
GHG – greenhouse gas
GLH – green leafhopper
GPS – global positioning system
GQ – grain quality
GUI – graphical user interface
GWS – genomwide selection
GYT – general yield trial
h – hour
ha – hectare
HIP - high inorganic phosphate
HPL – hybrid parental line
I - intermediate
ICIS – International Crop Information System
ICT – information and communication technology
IMO – indigenous microorganism
IF – inorganic fertilizer
INGER - International Network for Genetic Evaluation of Rice
IP – insect pest
IPDTK – insect pest diagnostic tool kit
IPM – Integrated Pest Management
IRRI – International Rice Research Institute
IVC – in vitro culture
IVM – in vitro mutagenesis
IWM – integrated weed management
JICA – Japan International Cooperation Agency
K – potassium
kg – kilogram
KP – knowledge product
KSL – knowledge sharing and learning
LCC – leaf color chart
LDIS – low-cost drip irrigation system
LeD – leaf drying
LeR – leaf rolling
lpa – low phytic acid
LGU – local government unit

LSTD – location specific technology development
m – meter
MAS – marker-assisted selection
MAT – Multi-Adaption Trial
MC – moisture content
MDDST – modified dry direct seeding technique
MET – multi-environment trial
MFE – male fertile environment
MLM – mixed-effects linear model
Mg – magnesium
Mn – Manganese
MDDST – Modified Dry Direct Seeding Technique
MOET – minus one element technique
MR – moderately resistant
MRT – Mobile Rice TeknoKlinik
MSE – male-sterile environment
MT – minimum tillage
$mtha^{-1}$ - metric ton per hectare
MYT – multi-location yield trials
N – nitrogen
NAFC – National Agricultural and Fishery Council
NBS – narrow brown spot
NCT – National Cooperative Testing
NFA – National Food Authority
NGO – non-government organization
NE – natural enemies
NIL – near isogenic line
NM – Nutrient Manager
NOPT – Nutrient Omission Plot Technique
NR – new reagent
NSIC – National Seed Industry Council
NSQCS – National Seed Quality Control Services
OF – organic fertilizer
OFT – on-farm trial
OM – organic matter
ON – observational nursery
OPAg – Office of Provincial Agriculturist
OpAPA – Open Academy for Philippine Agriculture
P – phosphorus
PA – phytic acid
PCR – Polymerase chain reaction
PDW – plant dry weight
PF – participating farmer
PFS – PalayCheck field school
PhilRice – Philippine Rice Research Institute
PhilSCAT – Philippine-Sino Center for Agricultural Technology
PHilMech – Philippine Center for Postharvest Development and Mechanization
PCA – principal component analysis
PI – panicle initiation
PN – pedigree nursery
PRKB – Pinoy Rice Knowledge Bank
PTD – participatory technology development
PYT – preliminary yield trial
QTL – quantitative trait loci
R - resistant
RBB – rice black bug
RCBD – randomized complete block design
RDI – regulated deficit irrigation
RF – rainfed
RP – resource person
RPM – revolution per minute
RQCS – Rice Quality Classification Software
RS4D – Rice Science for Development
RSO – rice sufficiency officer
RFL – Rainfed lowland
RTV – rice tungro virus
RTWG – Rice Technical Working Group
S – sulfur
SACLOB – Sealed Storage Enclosure for Rice Seeds
SALT – Sloping Agricultural Land Technology
SB – sheath blight
SFR – small farm reservoir
SME – small-medium enterprise
SMS – short message service
SN – source nursery
SSNM – site-specific nutrient management
SSR – simple sequence repeat
STK – soil test kit
STR – sequence tandem repeat
SV – seedling vigor
t – ton
TCN – testcross nursery
TCP – technical cooperation project
TGMS – thermo-sensitive genetic male sterile
TN – testcross nursery
TOT – training of trainers
TPR – transplanted rice
TRV – traditional variety
TSS – total soluble solid
UEM – ultra-early maturing
UPLB – University of the Philippines Los Baños
VSU – Visayas State University
WBPH – white-backed planthopper
WEPP – water erosion prediction project
WHC – water holding capacity
WHO – World Health Organization
WS – wet season
WT – weed tolerance
YA – yield advantage
Zn – zinc
ZT – zero tillage

List of Tables

Department of Agriculture

PHILRICE®

PHILIPPINE RICE RESEARCH INSTITUTE

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

We accomplish this mission through research and development work in our central and seven branch stations, coordinating with a network that comprises 58 agencies and 70 seed centers strategically located nationwide. To help farmers achieve holistic development, we will pursue the following goals in 2010-2020: attaining and sustaining rice self-sufficiency; reducing poverty and malnutrition; and achieving competitiveness through agricultural science and technology.

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

Central Experiment Station
Maligaya, Science City of Muñoz, 3119 Nueva Ecija
Trunklines: (44) 456-0277, -0285 • Telefax: (044) 456-0441
Email: prri@email.philrice.gov.ph

PhilRice Agusan
Basilisa, RTRomualdez, 8611 Agusan del Norte
Tel/Fax: 343-0768; 343-0778
Email: agusan@email.philrice.gov.ph

PhilRice Batac
MMSU Campus, Batac City, 2906 Ilocos Norte
Tel/Fax: (77) 792-4702; 670-1867
Email: batac@email.philrice.gov.ph

PhilRice Bicol
Batang, Ligao City, 4504 Albay
Cell: 0908-884-0724

PhilRice Isabela
San Mateo, 3318 Isabela
Tel: (78) 664-2954 • Fax 664-2953
Email: san_mateo@email.philrice.gov.ph

PhilRice Los Baños
UPLB Campus, Los Baños, 4030 Laguna
Tel: (49) 536-1917
Email: los_banos@email.philrice.gov.ph

PhilRice Midsayap
Bual Norte, Midsayap, 9410 North Cotabato
Tel: (64) 229-8178 • Fax 229-7242
Email: midsayap@email.philrice.gov.ph

PhilRice Negros
Cansilayan, Murcia, 6129 Negros Occidental
Cell: 0928-506-0515
Email: negros@email.philrice.gov.ph

PhilRice Field Office
CMU Campus, Maramag, 8714 Bukidnon
Tel/Fax: (88) 222-5744

PhilRice Liaison Office
3rd Flr, ATI Bldg., Elliptical Road,
Diliman, Quezon City
Tel/Fax: (02) 920-5129
Cell: 0920-906-9052

PhilRice Farmers' Text Center
0920-911-1398

PinoyRice Knowledge Bank
www.pinoyrkb.com

PhilRice Website
www.philrice.gov.ph

CERTIFICATION INTERNATIONAL
ISO 9001:2008 CIP/4360Q/09/1068
ISO 14001:2004 CIP/4360E/09/1068
OHSAS 18001:2007 CIP/4360H/09/1068