rice TODAY

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Partnership-driven rice science

Learning Alliance: A coalition for change
Transformation of rice farming in Asia
A "mad" scientist speaks candidly

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CONTENTS

rice TODAY Vol. 14, No. 4

About the cover

This issue recognizes the power of partnership. More than 900 institutions from around the world are brought together under the Global Rice Science Partnership (GRiSP) to create a synergistic force to overcome food security, poverty alleviation, hunger eradication, nutrition improvement, and sustainable development. In India, some organizations are taking up the cudgels of the completed CSISA project in Tamil Nadu, thus guaranteeing that the work the project left behind will continue to reach even more farmers.

In Myanmar, a learning alliance brings farmers, millers, traders, researchers, extension workers, and service providers together to find solutions for the country's rice sector. Helen Keller said, "Alone we can do so little; together we can do so much." Our cover represents that spirit of partnership. A grain of rice cannot do much. But millions of grains can feed the world. (Photo by Isagani Serrano)

Rice Today is published by the International Rice Research Institute (IRRI) on behalf of the Global Rice Science Partnership (GRiSP).

IRRI is the world's leading international rice research and training center. Based in the Philippines and with offices located in major rice-growing countries, IRRI is an autonomous, nonprofit institution focused on improving the well-being of present and future generations of rice farmers and consumers, particularly those with low incomes, while preserving natural resources. It is one of the 15 nonprofit international research centers that are members of the CGIAR consortium (www.cgiar.org).

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From the editor's desk

Strategic partnerships and alliances: VITAL TO IRRI'S SUCCESS

Strategic partnerships and alliances with rice-growing countries, donor countries, relevant research institutions in the developed world, and other organizations, which have endured for more than 55 years, have proven to be vital to the success of achieving the mission, goals, and initiatives of the International Rice Research Institute (IRRI).

With the Global Rice Science Partnership (GRiSP), the value of working together has never been so apparent. GRiSP, among other programs and projects, has created alliances with organizations that might not usually work together despite their shared goals of achieving food security, poverty alleviation, hunger eradication, nutrition improvement, and sustainable development. Under GRiSP, these partner organizations have contributed their own contacts, skills, talents, and assets resulting in broadened impact of rice science.

In this issue of *Rice Today*, we would like to recognize the importance of these partnerships and alliances.

Success stories in rice research and development have always been powered by partnering. GRiSP has more than 900 partners around the world. Our map section on pages 40-41 gives a perspective on the number of strategic partners that we have in Asia alone .

The story on page 15 (*Partnerships: Linchpin of last-mile delivery in Tamil Nadu)* elucidates on the effective partners involved in the Cereal Systems Initiative for South Asia (CSISA) in that Indian state. They are conducting both research and extension programs within the CSISA hub in the region to spread its technologies beyond the projects' life span.

In Myanmar, the Learning Alliance has provided a common ground for farmers and traders along with researchers, government extension staff, millers, and service providers to work together and encourage cooperation in finding solutions to problems (See *Learning Alliance: a coalition for change* on pages 33-36).

With the Asia Rice Foundation USA as a partner, young scholars are experiencing rice science hands-on through IRRI's popular *Rice research to production* course (see the story on pages 7-10).

Support from the European Union's EuroAid has enabled the development of the most efficient methods for rearing wasps as an effective biological pest control for farmers in the Mekong Delta. This alliance has brought together specialists from both the private and the public sectors to help design production facilities and train key persons in rearing these wasps (Read *Tiny wasps protect rice along the Mekong* on pages 11-13).

Partnerships among organizations have brought the big data approach to the rice sector in Latin America. Easier access to vast data sets has helped optimize rice production and improve decision-making through the use of large amounts of digital information from the farmers' fields. (Read *A date with big data in Uruguay* on pages 18-19).

In West Africa, the Africa Rice Center and other organizations have come together to develop a rice parboiling system designed for the women who must do this tedious task. The new technology reduces the amount of precious fuel and water needed, is safer for women, and produces higher quality parboiled rice than the traditional methods. This innovation platform is already making a big difference in the lives of women in Benin (See *A "GEM" for women rice processors on* pages 20-23).

Robert Zeigler has seen firsthand and up close how strategic partnerships have worked during his 30 years in agricultural research, including more than a decade as IRRI's director general. Since 2005, Dr. Zeigler has set the Institute's strategic direction and has also been a passionate spokesperson for a wide range of issues that affect rice growers and consumers worldwide. As he steps down in retirement in December, he discussed his career, which has spanned Asia, Africa, and the Americas. He mentioned a major challenge of getting on board with the private sector, which is increasingly interested in rice, while still maintaining the public persona of the institute. Learn about this *introverted "mad" scientist who speaks candidly and makes no apologies* on pages 24 to 29.

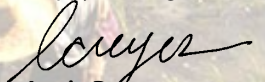
Get a glimpse of rice scientist Al Schmidley and his lifelong interest in Asia as a business model and value chain expert. Read about the people and partner organizations that he has worked with through his journey (see *Rice security is food security for much of the world* on pages 30-32).

IRRI senior economist Sam Mohanty also focuses on Asia in his analysis in his *Rice facts* column, *The ongoing transformation of rice farming in Asia* on pages 37-39.

In a very special Grain of Truth on pages 42-43, Bill Gates answers the question, *Who will suffer most from climate change?* He talks about the success of climate-smart rice such as flood- and drought-tolerant varieties developed by IRRI and its partners in helping the poor farmers who are most susceptible to the ill effects of climate change. Also learn how the Gates Foundation and its partners have worked together to help transform farmers' lives.

On a lighter note, on page 14, we have an exotic Ecuadorian rice dish, *Arroz con camarones.* This seafood-infused delight goes well with plantains and cold drinks. Perhaps you can savor the flavor of these combinations as you browse through this issue of *Rice Today*.

Happy reading!



Lanie Reyes
Rice Today managing editor

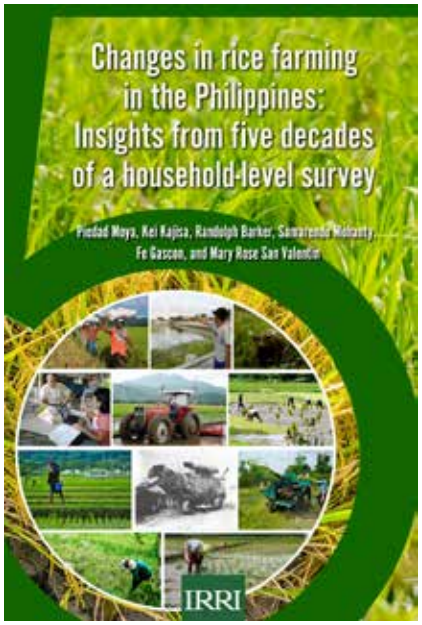
Changes in rice farming in the Philippines: Insights from five decades of a household-level survey

by P. Moya, K. Kajisa, R. Barker, S. Mohanty, F. Gascon, M.R. San Valentin

Published by the International Rice Research Institute, 145 pages

This book centers around the structural and economic changes in rice farming that have occurred in the Philippines during the past five decades. As a researcher at the International Rice Research Institute (IRRI) for more than 30 years, Piedad Moya, the lead author, has been a witness to these changes through her involvement and encounters with farmers. This experience has given her first-hand knowledge of what is actually happening in farmers' fields and with their families. Five years ago, she was given the responsibility to establish the social science database that involves the organization and consolidation of numerous farm-level data sets that IRRI's Social Sciences Division has accumulated over the years and make them available on the World Rice Statistics website. The farm household survey database is a collection of farm-level data sets on rice productivity, fertilizer and pesticide use, labor inputs, prices, income, demographics, farm characteristics, and other related data on rice production in farmers' fields.

The book consists of three major parts: (1) the main text that consists of eight chapters that deal with the quantitative data on rice production systems that present the trends and changes in yield, input use, and profitability of rice production over the years; (2) the last chapter consists of six case studies that focus on how the farm household and its family have changed over time; and (3) substantive appendices that contain not only detailed tables mentioned in the text, but detailed survey data per observation. A brief summary of all studies published or presented in a forum is also included as one section of the appendices. ■



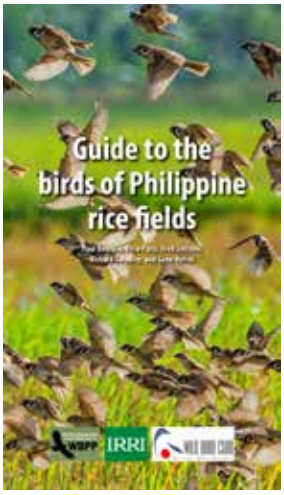
The PDF of this book can be downloaded free at http://tinyurl.com/IRRI-loop-survey.

For information on how to obtain a hard copy, contact: info@irri.org.

Guide to the birds of Philippine rice fields

by P. Bourdin, T. Paris, F. Serrano, R. Smedley, G. Hettel

Published by the International Rice Research Institute, 116 pages



Annually, Filipino farmers harvest more than 4 million hectares of rice fields within the country. Even though management and techniques differ from island to island, even among neighboring farmers, the overall habitat is similar and so, rice fields provide an important artificial wetland attraction for an area's biodiversity and for migrating "feathered" visitors.

Located 50 kilometers south of Manila on the slopes of the dormant volcano Mt. Makiling in Los Baños, Laguna, the International Rice Research Institute (IRRI) has spent more than 50 years developing new rice varieties for poor farmers and studying different environment-friendly and relatively pesticide-free methods of rice field management that farmers can use. The 209 hectares of rice fields on IRRI's experiment farm form a mosaic patchwork of different crop stages and varying degrees of wetland habitats, which make them a bird paradise.

Keeping a healthy rice ecosystem is a target for IRRI on the farm. For example, the Institute uses integrated pest management (IPM), which reduced pesticide application by 96% between 1993 and 2008 and encourages richer natural biodiversity. Although there is no direct evidence on the impact of the reduced pesticide use, it is certainly a contributor to richer bird life in and around the farm.

This guide will help bird enthusiasts identify birds—both common and rare—found frequenting rice fields in the Philippines, spotlighting particularly the rice fields on the IRRI farm as a microcosm for the country as a whole. All of these birds, most assuredly, can be seen in many rice fields within the Philippines, hence the title of this guide. This guide concentrates on the IRRI fields because they have been intensively surveyed over recent years like no other location in the country.

Highlighted are 93 species that actually use the fields, that is, hunting for food, sheltering within the rice plant canopy, and raising their broods. It also includes five years of observational records at IRRI to approximate what months these birds are most likely to be present. ■

Cost of the guide is USD6.00 per copy. To order copies, contact: info@irri.org

rice TODAY around the world

DISPLAYING SOME of their copies of the magazine, participants in IRRI's 3-week *Rice Research to Production* short course huddle under an Ifugao hut after discussing with local farmers how they produce their prized heirloom rice. About 25 course participants spent the weekend in Banaue, Ifugao, Philippines, to learn about the farmers' local activities and problems. See *IRRI's RR2P short course helps young scholars advance their careers in rice science* on pages 7-10.

THE SPECIAL issue of *Rice Today* about Latin America was well received by participants of the "Workshop on data mining of large commercial rice crops datasets" held in Treinta y Tres, Uruguay last June. A nice infusion of "Yerba mate" accompanied the reading by Natalia Queheille, technical advisor with the Rice Growers Association of Uruguay. See *A date with big data in Uruguay* on pages 18-19.

STAFF MEMBERS of the IRRI-Bangladesh Office hold copies of *Rice Today* in a group photo with visitors, Robert Zeigler, IRRI director general (*center*), Gene Hettel, *Rice Today* editor-in-chief (*second from right--blue shirt*), and Martin Gummert, IRRI senior scientist and postharvest specialist (*at far left in third row--brown shirt*). See Gene Hettel's *Pioneer interview with Bob Zeigler* on pages 24-29.

IRRI's RR2P short course helps young scholars advance their careers in rice science

Text and photos by Gene Hettel

ARFUSA SCHOLARS working together: Jenna Reeger (*left*) and Ana Bossa Castro watch Hussain Sharifi take a stab at pollinating a rice plant during one of the RR2P course's practical activities.

Getting their feet wet in rice paddies, three ARFUSA grant winners and other scholars learn how rice is connected to the international community.

"The hands-on experience of producing rice has certainly been relevant to my research," expounded Jenna Reeger, currently pursuing a PhD in plant biology at Penn State University. "Understanding how farmers prepare their fields and plant rice has certainly been enlightening thanks to traveling around the Philippines to see different areas where rice is grown."

This assessment of the International Rice Research Institute's (IRRI) 3-week short course on *Rice research to production* (RR2P) was the consensus of three graduate students attending universities in the United States and who also won recent Travel and Study Awards from the Asia Rice Foundation USA (ARFUSA). A unique situation in which three ARFUSA scholars participated at the same time in the RR2P, Ms. Reeger was joined in the ninth annual edition of the course, held at IRRI headquarters in the Philippines, by fellow 2015 winner Hussain Sharifi, a PhD student in the Agro-Ecosystems Laboratory at the University of California (UC) at Davis, and 2014 winner Ana Bossa Castro, a PhD student in plant pathology at Colorado State University.

Bringing a unique community of students together

"The RR2P course is becoming quite popular with ARFUSA scholars and other young scientists from around the world who are looking to advance their careers," said Jan Leach, distinguished professor at Colorado State University and one of the training coordinators for the course.

"The students touch on everything from learning how to prepare the fields and plant rice using a water buffalo as well as modern technology all the way to using molecular breeding tools," added Dr. Leach. "It is a huge opportunity for

DISCUSSING HER research with IRRI collaborator Chitra Raghavan, scientist in plant breeding (*left*), and Jan Leach, R2RP coordinator (*right*), Ms. Bossa Castro plans her next steps.

them to learn about rice production and the research that goes on at IRRI and around the world."

The course also brings together a special community of students. "Past participants often keep their interaction going," explained Dr. Leach. "So, they will have international colleagues in the rice research community for the rest of their careers. This is hugely important for their success. They also gain experience in communication, for example, how to present their research and how to make it understandable to lay people. They are also learning cultural aspects, not only the distinctive ways of rice production in the Philippines and other parts of the world, but also through interacting with scientists from different countries and learning to respect their culture."

Something "cool" about IRRI

Ms. Reeger, who is also a Penn State University Graduate Fellow, a Graham Endowed Fellow, and Roche/ARCS Foundation Scholar, grew up on a small vegetable farm in western Pennsylvania. "I learned about plants from a very young age," she explained. "Then I found I could study science involving plants in college. I became interested in agriculture, which I believe is a major concern that scientists should be focusing on."

Her main goal is to develop drought-tolerant rainfed rice varieties that will provide more reliable yields under drought stress and promote food security and financial stability for rainfed rice growers. "I find IRRI to be a unique place with so many different people working on all the aspects of rice," she said. "I think there is something special and 'cool' about this—a lot of people working together to achieve the same goal."

Regarding the RR2P course, she relayed that the "high point" was the 3-day visit to the Banaue rice terraces in Ifugao Province of northern Luzon. "The ancient rice terraces are very beautiful," she said, "and it was very interesting to talk with the people who live there and observe how they grow rice on the terraces with 2,000 years of experience."

Also during her time at IRRI, she was able to interact with scientists working on breeding for drought tolerance and the physiology of drought. "I met multiple times with Dr. Amelia Henry, IRRI's drought physiologist, to discuss her work and to make plans for my return trip to IRRI—for which I am using my ARFUSA grant to set up a field trial," she pointed out." The budding plant biologist is now back at Penn State taking classes in her second year of graduate school, where she is also president-elect of the Graduate Women in Science chapter at the university.

First in the family to obtain a college degree

Mr. Sharifi was born into a small-farm family in remote Bamyan Province of Afghanistan. He was the first in his family to obtain a college degree when he completed his BS in plant protection at Kabul University.

In his U.C. Davis research under the direction of Bruce Lindquist, a former IRRI scientist based in Laos, his main research focus is to improve water-use efficiency in current conservation agriculture rice systems. For example, in part of his research, Mr. Sharifi aims to develop a predictive tool in order to support improvements in rice breeding, production, quality, and management. "To this end," he

SHARING A light moment, Ms. Reeger and Mr. Sharifi discuss their favorite aspects of the RR2P course.

GAINING HANDS-ON experience, Ms. Bossa Castro (*right*) and Mr. Sharifi (*left*), along with other RR2P course participants, separate panicles in the rice bundles during their visit with farmers in Banaue.

said, "I am evaluating the effects of environmental factors—such as temperature, photoperiod sensitivity, and field management practices, including the alternate wetting and drying system—on rice growth and development.

"IRRI is certainly a premiere institute for rice science," he added. "I find the work being done here fascinating. The RR2P course provided me with a great opportunity to be exposed to many different topics and issues. More than that, a high point for me was getting to know and become friends with all the course participants from 12 countries. I'm sure I will come across many of these people again as colleagues at some point in my career."

Mr. Sharifi has a main interest in remote sensing. "I think we should use this technology to develop appropriate tools for extending available information to where we need to," he said. "My time here at IRRI has enabled me to interact with the GIS group and the crop modeling group (Oryza2000) with Tao Li and Ando Radanielson, Adam Sparks, and Steve Klassen. It is great that the scientists here are so willing to take the time to talk to a young scientist like me." He has returned to U.C. Davis to finish his PhD research in early 2016. "I plan to pursue a career in international crop research with a focus on rice cropping systems," he concluded.

She came back!

Attending the RR2P course brought Ms. Ana Bossa Castro back to IRRI a second time. The Bogotá, Colombia, native was here last year to receive training and to consult with Hei Leung, principal scientist in IRRI's Plant Breeding, Genetics, and Biotechnology Division and a collaborator in her research on finding novel resistance sources to defeat bacterial diseases of rice.

"I've worked as a research assistant at CIAT [International Center for Tropical Agriculture] in Cali, Colombia for a few years and I had been very interested in coming to IRRI and learning about the research done here," she said. "When I got here for the first time last year, I was impressed by the fields and the labs, the genebank, and the genotyping facility. This second time, I got the chance to know more about the cutting-edge research done in different topics and meet several scientists. Through the course, I had hands-on experience in field practices and interacted with farmers. The trip to Banaue was an enriching opportunity as I talked with local farmers and heard about their traditional practices and their limitations in rice production. The RR2P course allowed me to meet participants from 12 different countries, know about their cultures, and exchange research experiences with them."

Originally, Ms. Bossa Castro was interested in molecular biology to perhaps become involved in human cancer research; however, after taking a college class in plant pathology, she became interested in food security and feeding growing populations. "I changed my mind on what direction to take, but still could be involved with molecular biology—and maybe it is just as important as cancer research by benefiting even more people."

During her work at CIAT, she was a visiting scholar in the laboratory of Dr. Stephen Dellaporta at Yale University on two occasions. "There, I acquired and applied molecular techniques to make advances in my project," she said. "This gave me an opportunity to prove my creativity and initiative to cope with new research experiences."

Ms. Bossa Castro believes she is on track with her research to find new resistance genes for important bacterial pathogens. "With continued collaboration with IRRI and CIAT, my main goal is to contribute to the reduction of losses caused by these pathogens in rice crops, which will help decrease poverty and malnutrition in developing countries. I plan to become a principal investigator in molecular plant pathology to achieve this goal."

Unique RR2P course in its ninth year

Including these three ARFUSA scholars, the ninth annual RR2P course held during 10-28 August 2015 attracted 26 participants (photo on page 42) hailing from 12 countries (Afghanistan, Cambodia, Colombia, Egypt, India, Indonesia, Kenya, Nepal, Peru, the Philippines, Sierra Leone, and the U.S.). In addition to Dr. Leach, the course was coordinated by IRRI staff members Noel Magor, head of the Training Center; Dr. Leung; Jason Beebout, consultant; and Eugenio Castro, Jr., Training Center senior manager. For more information about this course and other training opportunities at IRRI, visit www.training.irri.org. ■

Gene Hettel is the executive director of ARFUSA.

PARTICIPANTS AND faculty involved in the 2015 *RR2P course* at IRRI, 10-28 August.

ARFUSA announces 2015 grant winners and sets deadline for 2016 applications

During their 16th annual meeting, held on 25 July 2015, the ARFUSA trustees announced four 2015 winners of the organization's Travel and Study Award Program. The objective is to help develop the next generation of young rice scientists (see *A solid foundation for the next generation of rice researchers* on pages 44-45 of *Rice Today*, Vol. 13, No. 4).

In addition to Ms. Reeger and Mr. Sharifi, who are featured in the story beginning on page 7, the 2015 winners also include **Anuj Kumar**, a Monsanto Beachell-Borlaug International Research Fellow doing PHD research on rice drought tolerance and water use efficiency at the University of Arkansas, and **Anne-Marie Mitchell**, a U.S. Peace Corps Volunteer (2014-16) in the West African country of Benin under the Master's International Program with Cornell University; Mr. Kumar is in the department of Crop, Soil, & Environmental Sciences (CSES) at the University of Arkansas, Fayetteville, with Dr. Andy Pereira as his major advisor. His project, *Development and Characterization of Rice Genotypes for Water-Use Efficiency and Drought Resistance*, is a collaborative research between University of Arkansas and IRRI. His aim is to screen the USDA rice mini-core collection for water use efficiency and drought resistance related parameters, generate and evaluate the populations (F_2, BC_1, etc.) from high-yielding, but drought-sensitive and drought-tolerant genotypes, and map QTLs for grain yield and drought-related parameters.

Upon his arrival at IRRI in late September 2015, he participated in the Institute's international Molecular Breeding Course. He will be staying at the Institute through December 2015 to conduct some research training including work with Dr. Arvind Kumar, leader of IRRI's rainfed lowland South Asia plant breeding group in which he will be phenotyping an F_2 population (*indica x glaberrima*) and some other advanced lines. He will also be learning other advance technologies to impose drought in the field.

Ms. Mitchell is studying international agriculture and rural development while in Benin. As a volunteer, she is serving as the Rice Programs Manager for the 2015 Food Security Committee where she is developing informational rice manuals and resources and training fellow volunteers on best management practices that can be implemented in their respective communities. The aim of her project is to reinforce best management practices and to advance simple technologies through the discovery of the most effective tools for weeding rice fields.

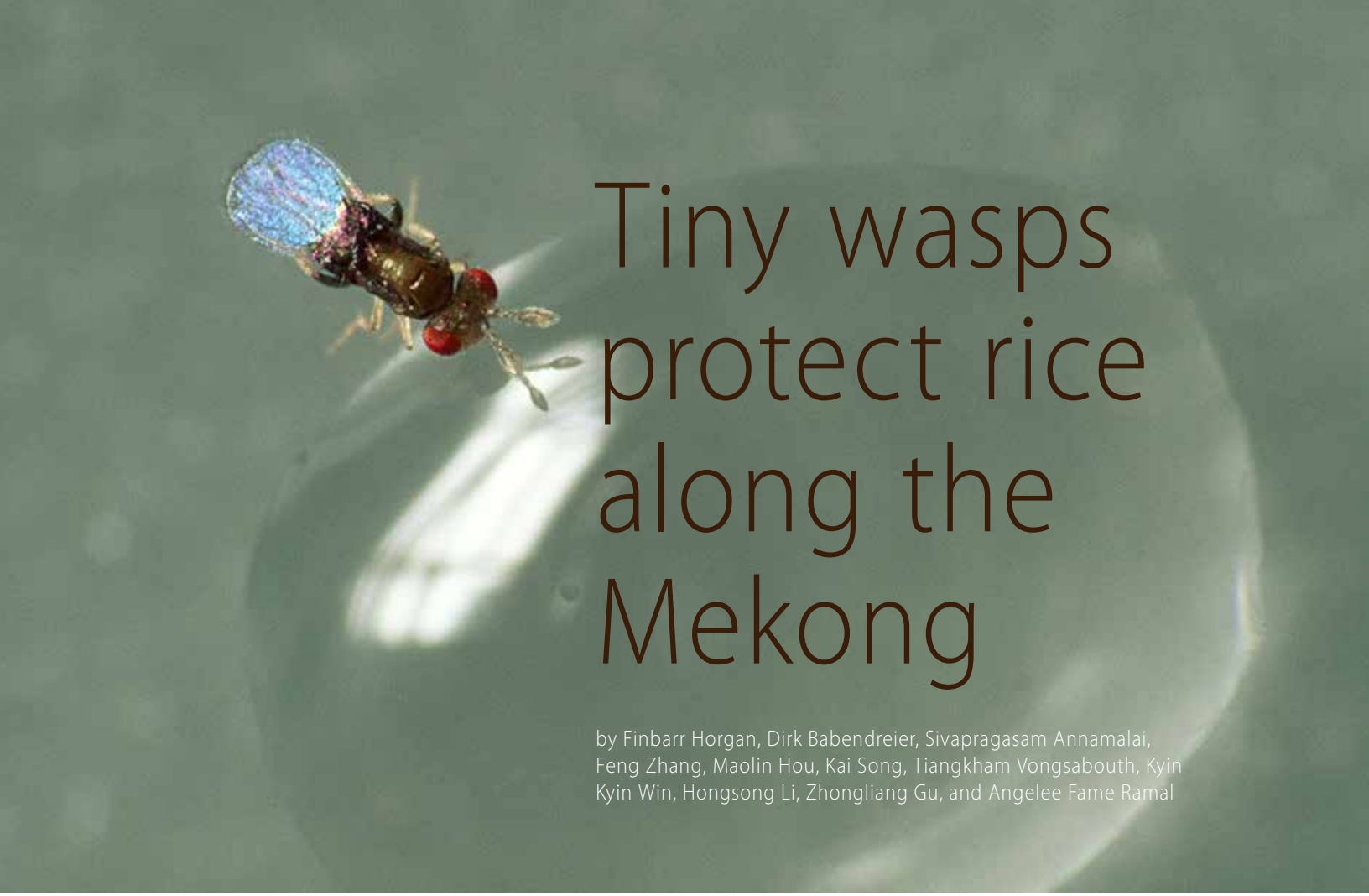
Through farmer experimentation, she hopes to determine the most suitable weeding instruments for the southeastern region of the country. With the assistance of the Union of Rice Farmers of the Oueme Plateau, the Collaborative Council of Rice Farmers in Benin, and Farm Integrated Agricultural Solidarity, 20 rice farmers from around the Oueme Department are being chosen to experiment with three different weeding methods: by hand or with a hand tool, with a cono-weeder, and using a locally-made, ecologically-adapted weeder. This equipment is financed by the ARFUSA grant.

2016 grant applications now being accepted

ARFUSA grants (up to USD3,500 per award) assist scholars and artists to learn more about rice in the developing world by subsidizing a trip to a country where rice is important to study aspects of rice production, marketing, consumption, and policy, or to create art or interpret culture related to rice.

The deadline for receiving the next round of grant applications is **1 June 2016**. Applicants who may be of any nationality must be registered students at an accredited U.S. university or college and have a letter of support from a university faculty member. Creative artists must illustrate their qualifications.

Evaluation of the applications is based on quality, likely contribution to knowledge or ability to cause people to think, potential contribution to resolving issues related to rice in Asia, and leadership potential of the applicant. For more information, go to www.asiariceusa.org/awards.html.



Tiny wasps protect rice along the Mekong

by Finbarr Horgan, Dirk Babendreier, Sivapragasam Annamalai, Feng Zhang, Maolin Hou, Kai Song, Tiangkham Vongsabouth, Kyin Kyin Win, Hongsong Li, Zhongliang Gu, and Angelee Fame Ramal

The Trichogramma are tiny beneficial wasps that feed on the eggs of several pests, including stemborers and leaffolders. To help rice farmers in the Greater Mekong Region, a project was launched in 2011 to promote the establishment of Trichogramma mass production facilities and affordable and practical pest control methods.

Rice is culture. It's a way of life along the Mekong—Southeast Asia's longest river. Six countries share the river, which begins as a small mountain stream on the Tibetan Plateau. After 4,300 kilometers of writhing through forests, swamps, farms, and towns, the river bursts toward the sea, creating one of Asia's great deltas—the Mekong Delta. Rice is produced all along the river from the highlands of Yunnan, including the ancient Honghe Hani Rice Terraces, to the balmy delta region of South Vietnam. Farmers along the river represent a diversity of cultures including the Dai, Hani, Khmu, and Karen peoples. Despite this diversity, these cultures all share a common responsibility of protecting the health of the Mekong. To achieve a healthy river, farmers must first maintain a healthy rice environment.

Tiny wasp, big project

A project, funded through EuropeAid of the European Union, was launched in 2011 to help rice farmers in the Greater Mekong Region reduce their pesticide use and improve the sustainability of their rice farms. The project turned to an unlikely source for help: a tiny parasitic wasp called Trichogramma. These wasps are less than one millimeter long—their tiny size can be attributed to their specific life history as they develop inside the eggs of herbivorous insects, particularly moths. Trichogramma

A "TRICHOCARD" contains about 1,500 Trichogramma eggs. (Photo by Maolin Hou, Chinese Academy of Agricultural Sciences)

STEMBORER LARVAE inside the rice stem are protected from chemicals, but Trichogramma wasps will track the larvae inside the stem or parasitize the stemborer egg masses on the leaves. (Photo by Maolin Hou Chinese Academy of Agricultural Sciences)

wasps will feed on the eggs of several moth species, but in rice they mostly attack the eggs of stemborers (*Scirpophaga* spp. and *Chilo* spp.) and leaffolders (*Cnaphalocrocis* spp.)—two insect pests feared most by farmers.

Adult female wasps actively seek out the eggs of the stemborer and leaffolder in rice fields. Once an egg is located, the wasp deposits her own eggs into it. Within about 10 days, instead of caterpillars emerging from the stemborer eggs, completely-formed, young adult wasps come out—with an appetite for more stemborers. The highly efficient Trichogramma wasps naturally inhabit rice fields; however, they are sensitive to chemical pesticides. The high use of pesticides in many rice-growing areas has depleted the numbers of Trichogramma and other natural enemies of rice pests, which leaves farms vulnerable.

Protection by wasps

The project promotes integrated pest management (IPM) by establishing rearing facilities to produce Trichogramma wasps and distribute these to local farmers, including farmers of the Dai and other local cultures. The project target was to create four Trichogramma rearing facilities in each of three Mekong countries: China (Guangxi and Yunnan Provinces), Lao PDR, and Myanmar.

Eleven of these facilities have been completed in Dehong and Xing'an in China; Yangon, Mandalay, and Shwebo in Myanmar; and Vientiane and Sayabouri Provinces in Lao PDR. The final facility will be constructed near Yezin Agricultural University in Myanmar in 2015.

Producing Trichogramma is not a simple task. The wasps need moth eggs on which to feed and develop. Thus, the project uses a nonpest species, the Corcyra moth (*Corcyra cephalonica*) as a production host. Millions of Corcyra eggs are produced each day in the rearing facilities as food for the developing Trichogramma wasps. While the tiny wasps are still developing inside the Corcyra eggs, they are attached using a light adhesive to special cards called "Trichocards," which the farmers can hang on their rice plants during the most vulnerable crop stages. Each Trichocard contains about 1,500 developing Trichogramma. Once they emerge

YOUNG SCIENTISTS from China and Lao PDR learn together about the ecology of beneficial rice insects. (Photo by Dirk Babendreier, CABI)

STEMBORER LARVAE feeding at the rice base steal resources from the developing rice panicle giving rise to empty grains or whitehead. (Photo by Artzai Solano)

from the Corcyra eggs, they fly off and seek out the eggs of stemborers and leaffolders in rice fields. Each rearing facility is expected to reach a target of 600–700 hectares of rice fields protected by the wasps.

Successful collaboration

To develop the most efficient methods of rearing the wasps and bringing them to the farmers, the project brought together a group of specialists. Tianyi Biological Control Company Ltd., (in Hengshui, Hebei, China), a company with experience in the mass production of biological control agents, helped design the production facilities and trained the managers and staff at each facility to rear the Trichogramma wasps. Experts from government plant protection centers in each of the three countries monitored the incidence of stemborers and pinpointed the most vulnerable rice-growing regions, where rearing facilities and IPM training were most needed. Extension workers and social scientists worked with farmers to understand farmers' attitudes and perceptions of pest management and introduced them to the merits of using biological control and the need to reduce pesticide use in rice.

The project's progress has been impressive. The thousands of farmers that have been introduced to this biological control method are interested and supportive. Furthermore, several national agricultural research and extension institutions have shown keen interest in adopting this biocontrol-based IPM approach. The Plant Protection Station in Guilin, Guangxi Province, China, for example, plans to initiate its own rearing facility this year.

This project is an important step forward in the huge rice bowl that is the Greater Mekong Region. Its success should encourage scientists, agricultural and extension workers, and rice farmers to initiate similar projects and better understand the importance of beneficial insects that inhabit rice fields. Although they are never seen by most people, tiny organisms like the Trichogramma wasps are the first line of defense against harmful pests. Managing the rice environment to create optimal conditions for these farmer-friends will ensure sustainable rice production along the Mekong for generations to come. ■

Dr. Horgan is an ecologist-entomologist whose research focuses on rice ecosystem services. Dr. Babendreier is a senior scientist at CABI-Switzerland. Dr. Annamalai is a senior scientist at CABI-Malaysia,Dr. Zhang is country director for CABI-China. Dr. Hou is project scientist and a professor on rice insect pests at Institute of Plant Protection, Chinese Academy of Agricultural Sciences. Mr. Song is chief engineer at Tianyi Biological Control Company Ltd; Mr. Vongsabouth is the deputy director, Plant Protection Center, Lao PDR. Dr. Win is the deputy director of the Plant Protection Division, Myanmar. Mr. Li is the deputy director of the Agricultural Bureau, Xing'an, Guangxi Zhuang Autonomous Region, China. Mr. Gu is the director of the Plant Protection and Quarantine Station, Dehong, Yunnan Province, China. Ms. Ramal is a researcher in entomology at IRRI.

DAI PEOPLE perform a welcome dance. Farmers at Dai villages use Trichogramma to control stemborers. (Photo by Finbarr Horgan IRRI)

by Laly Paredes and Cristina Blackman


Ms. Blackman with her finished delicacy.

Arroz con camarones

Photos by Isagani Serrano, IRRI

A coastal Ecuadorian dish usually served with sliced avocados or fried plantains and cold drinks.

This dish has been prepared for generations on both sides of my family. My maternal grandmother, Angeles Montesdeoca Cordero, loved seafood and learned to make it during the many summers she spent at her uncle's house in Manabí, Ecuador. My mother, Laly Paredes, cooked this dish regularly for my siblings and me growing up in Cuenca. I am just learning to cook and perfect it myself so that one day my daughter, Eva Kay, can share it with her own kids. That's tradition!

Ingredients

1 kg raw shrimps, shelled and deveined. (Set aside the heads for homemade shrimp broth.)
2 tsp cumin
8 garlic cloves, minced
1 tsp mustard
2 tbsp canola oil
2 cups uncooked long-grain white rice
3 cups chicken broth or shrimp stock (or 1.5 cups of each)
3 tbsp butter
1 red onion, thinly diced
1 red or green bell pepper, diced
2 large tomatoes, peeled and diced
3 tbsp cilantro, finely chopped
1 tsp achiote (achuete or annatto)
½ cup white wine
salt and pepper to taste

Directions

1. Marinate the shrimps with salt, pepper, mustard, 1 tsp cumin, and half of the minced garlic. Let this rest for an hour.
2. Bring water to boil in a large pot, add about 7 shrimp heads, and boil for 7 minutes.
3. Remove the shrimps from the water and reserve 3 cups of the water they cooked in to prepare the rice. If you lack time, you could skip this step and cook the rice with 3 cups of vegetable or chicken broth.
4. Heat the oil in a large pot and add the remainder of the minced garlic. Cook for 2–3 minutes on medium heat.
5. Add the rice to the garlic and oil. Mix until the rice is coated with oil and the color turns off-white (5–10 minutes).
6. Add the 3 cups of chicken broth or shrimp stock to the rice, bring to a boil, and then reduce heat to low until the rice is cooked.
7. Melt the butter and achiote over medium heat in a large sauté pan. Add the onions, bell pepper, tomatoes, salt, pepper, and 1 tsp of cumin. Cook for about 10 minutes, stirring often.
8. Add the white wine to the vegetable mix and continue cooking for another 5 minutes, until the onions and the bell pepper are tender.
9. Mix in marinated shrimps for about 3 minutes or until cooked. Make sure you don't overcook the shrimps.
10. Add the sautéed shrimps and vegetables to the cooked rice and mix well. Keep on low heat.
11. Mix in cilantro.
12. Add salt and pepper to taste.
13. Serve with fried plantains or avocado slices.

Serves 6–8 persons.

Bon appétit!

Cristina enjoys being a wife and a mom and loves to cook for her family and friends. She attributes her knowledge of Ecuadorian cuisine to her mother, Laly Paredes. Cristina spends her free time working out in the gym. She also finds time to nurture her interest in spirituality, psychology, and marriage counseling.

She aims to contribute to IRRI and the Los Baños community to which she now belongs.

From Louisiana, USA, Cristina has joined her husband, Bryce Blackman, an agronomy extension and training specialist at IRRI.

Watch Cristina demonstrate how to prepare this delicious dish in an 8:13-minute video on YouTube at https://youtu.be/rn1_KhsbZh8.

PARTNERSHIPS:

Linchpin of last-mile delivery in Tamil Nadu

by Lanie Reyes

Partners in Tamil Nadu, India, have committed to further disseminating a range of technology options under the Cereal Systems Initiative for South Asia (CSISA).

"Celebration is an apt title for the event," said Noel Magor (photo), head of the Impact Acceleration Unit and Training at the International Rice research Institute (IRRI), as he glanced at the text written across the tarpaulin that reads *CSISA Tamil Nadu Hub Celebration Workshop*. "The CSISA project in Tamil Nadu has accomplished a lot in a short time. Our partners' contribution has been the key significant aspect of thie success of this work in Tamil Nadu."

Over the past 5 years, the water- and labor-saving technologies under CSISA have reached more than 25,000 farmers and have covered around 2,800 hectares in Thanjavur, Thiruvarur, and Nagapattinam districts of the Cauvery Delta and the neighboring districts of Ramanathapuram and Sivagangai, in the Tamil Nadu State of southern India. These technologies include laser land leveling, improved and mechanized dry direct seeding of rice, mechanical transplanting of rice under both puddled and nonpuddled conditions, rice crop management, alternate wetting and drying, and line sowing using a multicrop seeder under reduced-tillage conditions. These have helped farmers in Tamil Nadu increase their profits.

"Farmers can save about 40% on the cost of labor because renting a farm machine is cheaper than hiring manual labor," said R. Ganeshamoorthy, CSISA hub manager in Tamil Nadu. "A farmer's profit from the dry direct-seeded rice is twice as much as that from the regular way of growing rice. By not puddling the field and using shorter-duration crops, farmers can save water by 25–35%. And, depending on the rice variety, farmers can increase their yields by 7–10%."

(Photo by Jessieca Narciso, IRRI)

Another technology that is improving the efficiency of crop production is laser land leveling. It has already found its way to the hearts of farmers in the Cauvery Delta because of the precision leveling, uniform crop maturity, and water savings of 30–40%, and increased input-use efficiency.

And so has machine-transplanted rice in nonpuddled soil. "Compared with puddled transplanted rice, farmers in Tamil Nadu can save as much as 48% of the labor cost from land preparation, 50% for irrigation, and 67% from the cost of seed and sowing," said Mr. Ganeshamoorthy. "Through this technology, farmers can save around USD100 or about 20% of the overall production costs."

Working together

"Working together with several key organizations is pivotal to the success of the widespread adoption of these technologies in Tamil Nadu," said Dr. Magor. "In 2013, for example, the use of seed drilling and laser land leveling machines was endorsed by the Tamil Nadu Agricultural University (TNAU) while the Department of Agriculture facilitated and subsidized the purchase of machines for distribution to farmers."

Tamil Nadu Rice Research Institute (TRRI), the National Bank for Agriculture and Rural Development, the ITC Agribusiness Division, Syngenta, MS Swaminathan Research Foundation (MSSRF), and the Reliance Foundation also supported the research, capacity-building, and extension work toward large-scale adoption of the technologies.

These partners share CSISA's goal of increasing the food and income security of resource-poor farm families in South Asia through the development and deployment of new varieties, sustainable management technologies, policies, and partnerships. The project has been promoting durable change across South Asia's cereal-based cropping systems for several years now. It operates through rural "innovation hubs" in Bangladesh, India, and Nepal, and complements regional and national efforts.

Lasting legacy

"The CSISA research hub is a model success story because our partners carry on the development initiatives even when the project has ended," explained Dr. Magor. "This is a triumph for the CSISA Tamil Nadu hub."

Perpetuating these technologies is what TNAU has vowed to do. "TNAU will take up outscaling key technologies under CSISA," said R. Rajendran, TNAU agronomist, who has been associated with the CSISA project for the last 7 years. "The university will follow through on extending technologies such as improved dry-seeded rice cultivation, nonpuddled machine-rice transplanting, and laser land leveling.

"The technologies have been widely demonstrated in the Cauvery Delta through the CSISA project," he added. "Also, the research initiatives conducted through CSISA will not stop. The research outcomes will be taken continually to the farmers with support from the Tamil Nadu government and TNAU."

Similarly, TRRI and the Soil and Water Management Research Institute (SWMRI) are working closely with the CSISA team and partners to further spread the adoption of the technologies, not only in the Cauvery Delta, but also across the rice-growing areas of Tamil Nadu. TRRI hosted the CSISA project's research platform while SWMRI delivered the CSISA technologies in the Cauvery Delta.

"Tamil Nadu and IRRI have maintained a long-standing relationship for more than four decades through a number of projects," said Dr. Rajendran. "The footprints left today by the impact of the CSISA technologies in the Cauvery Delta will live on. Truly, the dry-seeded rice technology and the use of seed drilling have decreased the amount of fertilizer and seeds used by farmers, which eventually reduced their cost of rice production and increased their income.

"With the impact of the CSISA technologies and the continuation of the initiatives, I am optimistic that the relationship between TNAU and IRRI will continue in the next 10 years," he added.

THE CSISA TEAM instructs farmers and service providers in Tamil Nadu on how to use a mechanical transplanter. (Photo by CSISA Tamil Nadu Hub)

Aside from the government institutions, NGOs such as MSSRF and the Reliance Foundation will also continue some of CSISA's activities. MSSRF will maintain the season-long training program for trainers and extension workers. The program was first conducted for select extension staff of the Department of Agriculture of the government of Tamil Nadu from Thiruvarur and NGOs such as MSSRF. The program was a response to a request from the department to CSISA and IRRI, to help and improve the practical capacity of the extension workers in direct seeded rice cultivation and management.

MSSRF has been expanding the season-long training to farmers in other districts in Tamil Nadu and will eventually reach thousands of farmers. Including farmers in the training of trainers' program is the most logical thing to do because several studies indicate that 20% of the information to farmers comes from fellow farmers compared with other channels such as newspapers, extension workers, radio, and television.

DHANASEKAREN VEDCHALAM (*left*), a Reliance Foundation staff member, shares the Foundations' plan to spread direct-seeded rice technology to Tamil Nadu farmers. (Photo by Jessieca Narciso, IRRI)

GETTING BEHIND the wheel for hands-on experience on using laser-guided land leveling technology. (Photo by CSISA Tamil Nadu Hub)

"The diffusion of the CSISA technologies through the farmers will be easier because the farmers are basically happy with yield following the improved management practices involving dry direct-seeded rice," said Sudhakar, an MSSRF scientist. The technology gives farmers an average of 6.4 tons per hectare. To put this yield into perspective, the land in the districts of Sivagangai and Gautauram is mostly arid. But these parched lands are now producing bountiful harvests.

But yield is only half of the story. The other important half is the profit that farmers gain from direct-seeded rice. They are saving water and reducing labor costs through CSISA's conservation technologies.

India, dubbed one of the silent tigers in Asia, has blossomed economically. With high-rise buildings sprouting like mushrooms in Bombay, New Delhi, and even in the once humdrum city of Hyderabad, it is easy to understand why farm laborers migrate to these cities, which has created a labor shortage in rural areas. The seed drill and laser land leveling, which are part of the technology package of direct-seeded rice, are mitigating this labor-shortage in Tamil Nadu.

Another partner that has been sharing CSISA technologies is Reliance Foundation with its Rural Transformation Program, which is now turning once unproductive parched lands into lush rice fields. Poornima Shankar, India-based knowledge management and outreach specialist at IRRI, witnessed the transformation of the landscapes in Sivagangai and Ramanathapuram.

"The project is proud to reach more than 25,000 farmers," she said. "More good news is that this number is expected to double or even triple now that both government and nongovernment organizations will continue what CSISA has started in both research and extension activities."

"The critical value of building partnerships with key institutions and individuals is seldom highlighted in final reports to donors," said Dr. Magor. "These partnerships have been established over time with reputation, trust, and credibility as capital. The links to these organizations have become solid enough that it is easy for an IRRI scientist to communicate with key leaderships in Tamil Nadu without the hassle of formalities."

Truly, with partnership as the linchpin of this hub research, the technology spread to farmers will be more effective and efficient. Partnership and active engagement are essential in IRRI's work. ■

Ms. Reyes is the managing editor of Rice Today.

MR. GANESHAMOORTHY, Dr. Shankar, and Dr. Magor each receive a shawl as a token of gratitude from IRRI partners Dr. Rajendran, Dr. S. Porpavai, head of Soil and Water Management Research Institute; and Dr. V. Ravi, director of the Tamil Nadu Rice Research Institute. (Photos by Jessieca Narciso, IRRI)

A date with **BIG DATA** in Uruguay

by Adriana Varón Molina

ABOUT 30 representatives from rice-growing companies, mills, and research centers from Uruguay, Argentina, Chile, Brazil, and Colombia met in Treinta y Tres, Uruguay to learn about the big data approach. (Photo by CIAT)

The big data approach helps optimize rice production and seeks to improve decision-making in agriculture by analyzing large amounts of information from farmers' fields.

It was definitely *not* love at first "byte." Gonzalo Rovira had carefully prepared for this first date. Years of experience assured him that all would go well. But when the big moment arrived, he felt intimidated.

His date was a platform named "R," which is widely used by scientists and statisticians for data analysis. Mr. Rovira had a long story to tell, which goes back 20 years, when he first took up responsibility for compiling information on planting dates, irrigation time, herbicide applications, varieties, yields, and other rice data.

Fascinated by data

Mr. Rovira is the agronomist who heads the technical department of Coopar, S.A., an agroindustrial rice mill in Uruguay. He jealously guards the rice information in a trove of Excel files. Thanks to this popular application, he can process data for more than 20,000 hectares and provide the land's owners, the partners in Coopar, with valuable information that helps them optimize rice production.

"We were making good use of the information, but we knew that behind these data, there was a lot more," said Mr. Rovira, who runs the group of five technicians charged with capturing information from a large proportion of Uruguay's rice growers. Working sometimes with nothing more than a notebook or a piece of paper, he has fed the Coopar database constantly for 2 decades.

He and 25 other colleagues representing rice producers, millers, and research centers in Uruguay, Argentina, Chile, Brazil, and Colombia gathered recently at Treinta y Tres, Uruguay, the rice capital of this *gaucho* or cowboy country, for a workshop on big data analysis for commercial rice production.


GONZALO ROVIRA, technical manager at Coopar, S.A., Uruguay. (Photo by CIAT)

The objective of this week-long event—organized by Center for Tropical Agriculture (CIAT) as well as several national and regional partners with support from the World Bank—was to present and promote the use of new techniques for analyzing agricultural information. The challenge for participants in this big data feast was to get to the bottom of information on one of Latin America's most important food crops.

Natalia Queheille, a technical adviser for the Uruguayan Rice Growers Association was among the participants. She brought along 18 years of information condensed into a large number of spreadsheets. After carefully sifting through the data and carrying out what experts call "data mining," Ms. Queheille and her colleague Fernando Pérez, who works for Uruguay's National Institute of Agricultural Research (INIA), began to see relationships between figures joined by strange codes and symbols—the same dashes, asterisks, equal signs, brackets, and periods that had intimidated Mr. Rovira in his first encounter with the tool.

An approach whose time has come

The big data approach seeks to improve decision-making in agriculture through the use of advanced methods to analyze large amounts of information from farmers' fields. But is it the right time for this approach in agriculture?

Erick Fernandes, an advisor for programs on climate change, agriculture, and forestry in the World Bank, believes it is.

"Previously, new information technology wasn't our best ally," said Mr. Fernandes. "But now it enables us to bring together and analyze information, taking advantage of new capacities in research centers and farmers' willingness to share their data, with the aim of finding more effective ways to improve crop production systems, which is vital not only for Latin America but the whole world."

Daniel Jiménez, agronomist and data scientist at the Colombia-based CIAT, agrees with the World Bank adviser.

"Previously, computers couldn't handle the methods we use for big data analysis, which are based on artificial intelligence and machine learning," said Dr. Jiménez. "But now, we're able to use these methods, and more people believe that this information, despite being beyond our control, offers a great opportunity to improve decision-making in agriculture, resulting in production systems that are more resilient in the face of climate change."

Data champions

The information brought to the big data workshop by Daniel Kruger, who works for Argentina's National Institute of Agriculture and Livestock Technology (INTA), is a treasure. One of the three databases that INTA maintains has climate information for the last half century.

Mr. Kruger, an expert in rice crop protection and management, recognizes the value of giving this information the careful refinement that it needs.

"It's really important to have data on climate and crop management for 10 seasons or more, because this enables us to determine what has happened in the past and project the future," he said. Though he already knew about the R platform, the workshop helped him discover its full potential.

Uruguay, Chile, and Colombia are also pioneers in building databases on rice crop management, yields, and climate. The records of the rice industry, producers, and national research institutes in these countries include data going back more than 35 years.

Colombia and beyond

CIAT's first experience in bringing the big data approach to the rice sector took place in Colombia. Carried out in collaboration with the country's National Rice Growers Federation (Fedearroz), this analysis led to new crop management recommendations that are helping farmers boost yields and make their crops more resilient.

The analysis involved large amounts of data provided by Fedearroz, including information from annual national rice surveys together with harvest monitoring records and the results of agronomic experiments, particularly on planting dates. Researchers also took advantage of agroclimatic forecasts generated by a project on climate and Colombia's agricultural sector—led by CIAT with support from the Ministry of Agriculture and Rural Development—as well as weather data provided by Fedearroz and the Colombian National Institute of Hydrology, Meteorology, and Environmental Studies (IDEAM).

In recognition of this novel research, the United Nations Global Pulse selected it to be one of two winners of the Big Data Climate Challenge, which was awarded during the UN Climate Summit held in September 2014 at New York City (see *Harnessing big data for climate change* on pages 40-41 of *Rice Today* Volume 13, No. 4). The research won further recognition from the World Bank, which is supporting CIAT's effort to replicate the Colombian experience elsewhere in Latin America.

"Agricultural organizations are ready for this approach, so we at CIAT together with the community of users of big data techniques have an important responsibility to share our experience," said Sylvain Delerce, who works with CIAT's big data team. "In this effort, the cooperation of organizations like the Latin American Fund for Irrigated Rice (FLAR) and International Research Institute for Climate and Society is key."

But the idea is also to take the big data approach beyond Latin America. "We're talking about organizing an event that involves Latin America and Africa to share the work taking place and to show how big data can help governments with their planning and investment in agriculture," said Holger Kray, a principal agricultural economist with the World Bank.

2 become 1

As the cold winter hours and days passed during the big data workshop, which was held at INIA's facilities in Treinta y Tres, Mr.Rovira became captivated by R's charm. By the time all was said and done, the 59-year-old agronomist and R had practically become one.

Back at his rice mill, Mr. Rovira will keep on urging technicians and farmers to share their data after every harvest. He'll also talk with them about which varieties are better adapted and which aspects of the climate or soil or crop management have the most impact on yields. His goal will be to detect tendencies and possible dangers—but now with valuable aid from R, his newfound life companion. ■

Ms. Varón Molina is communications coordinator for Latin America and the Caribbean at CIAT.

A "GEM" for women rice processors

by Savitri Mohapatra

A rice parboiling system improves the livelihood of hundreds of women in Benin.

An improved rice parboiling system developed by the Africa Rice Center (AfricaRice), combined with training and the adoption of an innovation platform approach along the rice value chain, is starting to make a difference in the lives of more than 450 women in the Glazoué rice hub in central Benin. It shortens processing time, reduces drudgery, and does not expose the women parboilers to heat burns.

Rice parboiling involves the practice of partially boiling rice in the husk before milling to make the rice firmer, less sticky, and more nutritious than nonparboiled rice. Parboiled rice is preferred in parts of Benin, Nigeria, and Ghana, and in other countries of West and Central Africa. It is reported that the bulk of the rice imported into Benin is parboiled rice, which enters the Nigerian market through informal channels. The demand for good-quality parboiled rice is high because it is already clean and easy to cook.

Designed for women

Rice parboiling is mainly performed by rural women in these regions and it significantly contributes to their livelihoods. However, the process is laborious, time-consuming, unsafe, and inefficient. It requires lots of firewood and water. Additionally, the traditional parboiling process using rudimentary equipment and methods often produces low-quality rice with many impurities, broken and burned grains, and undesirable smell.

According to Sali Ndindeng, AfricaRice grain quality and postharvest scientist, unless rice processing technologies can produce a marketable product, consumer demand will not be satisfied by locally produced rice.

To reduce women's drudgery and to improve the milling yield and quality of local rice, AfricaRice, led by Dr. Ndindeng, designed a prototype based on improved models from the Institute of Agricultural Research for Development in Cameroon, the Food Research Institute in Ghana, and the National Institute for Agricultural Research in Benin (INRAB). The new technology was code-named Grain quality enhancer, Energy-efficient and durable Material (GEM) parboiling technology. GEM technology consumes much less fuel and water than the traditional system and is safer and more durable. It is equipped with hoists and rails to lift and move the heavy vessels in which the paddy is steamed.

The small-scale locally adapted parboiling prototype was fine-tuned in close collaboration with McGill University, Canada, as part of a joint project with support from Canada's Department of Foreign Affairs, Trade, and Development.

PARBOILING the GEM way. (Photos by R. Raman, AfricaRice)


PADDY DRYING after parboiling.


USING PULLEY to transport vessel.

A GEM technology system was set up in Glazoué through the Support to Agricultural Research for Development of Strategic Crops in Africa (SARD-SC), an African Development Bank-funded project. Members of the Women Parboilers' Association in Glazoué were consulted at every stage of the development and testing process and were trained in best practices for the various components of parboiling. These women, in turn, trained other members of the Association from Glazoué and Malanville, in northern Benin, which is an important hub for irrigated rice.

Immediate impact

After only two months, the average monthly quantity of parboiled rice produced as well as the average monthly income from this activity more than doubled compared with those obtained using the traditional parboiling system.

With the traditional system, the women parboilers were processing only about 120 kg of paddy per session. Using GEM technology, they were able to process 300 to 400 kg of paddy per session. They have plans to increase the amount to 1 ton.

Moreover, the quality of the parboiled rice is similar to that of premium imported rice. Trials showed that, with GEM technology, there was less than 2% burned grains, 90% whole grains, zero chalkiness, and zero impurity compared with about 24% burned grains, 60% whole grains, more than 20% chalkiness, and 5% impurities with the traditional system.

"The quality is much better now. Traders from here and from Cotonou are readily buying up all our rice and are also giving us a better deal," said Mrs. Batcho Léontine, chair of the Glazoué Women Parboilers' Association. "Now, we can pay our children's school fees and take care of medical and other household expenses without having to ask our husbands for money."

Economically valuable technology

"The GEM parboiling unit, which can be easily built locally, provides an opportunity to improve the quality and competitiveness of locally produced rice," Dr. Ndindeng said. "But it is also important to keep in mind that improvements in rice quality require upgrading by actors throughout the value chain."

The innovation platform (IP) enhanced the effectiveness and sustainability of the GEM technology by helping build trust among the various actors involved in the Glazoué rice hub: the rice farmers' association, the women parboilers association, millers, input dealers, traders, blacksmiths, microfinance agencies, extension service, the nongovernment organization Vredeseilanden (VECO), community radio, as well as INRAB and AfricaRice.

"These achievements have been possible because of the availability of a promising technology and training," said Dr. Sidi Sanyang, leader of the Rice Sector Development Program and SARD-SC project coordinator for AfricaRice. "But the success is also due to the establishment and facilitation of the innovation platform along the rice value chain in the Glazoué hub."

"The IP encouraged farmers and entrepreneurs to participate in the rice value chain as an additional source of income," said Dr. Sanyang. "It allowed the women parboilers to be more competitive by integrating them into rice value chains." A positive indicator of this is that the Glazoué Town Hall is now promoting the sale and consumption of locally parboiled rice through contractual arrangements with women parboilers.

Dr. Sanyang added that the SARD-SC project is focusing on training in value addition, marketing contractual arrangements, quality packaging and labeling, and leadership. It is also helping young people to become acquainted with the agri-business aspects of parboiling. Building on this successful model, AfricaRice and its partners are planning to set up a similar parboiling system within the IP process in Malanville.

"AfricaRice's Strategic Plan promotes cross-cutting research to benefit rural women and the development of more inclusive and gender-equitable rice value chains," said AfricaRice Director General Harold Roy-Macauley. "We are happy that the world community recently adopted 17 Sustainable Development Goals, which include gender equality, among others." ■

Ms. Mohapatra is the head of Marketing and Communications at AfricaRice.

The ASEAN Ministers of Agriculture and Forestry (AMAF) have voiced their unequivocal support for agriculture innovation and building the next generation of rice scientists. This will ensure food security and strengthen cooperation in agricultural development across the region through the Rice Action Plan developed by IRRI through the Global Rice Science Partnership (GRiSP). On 12 September 2015, AMAF visited IRRI to learn about the institute's work in the region and in their respective countries. (Photo by Isagani Serrano)

An introverted "mad" scientist SPEAKS CANDIDLY

Dr. Robert S."Bob" Zeigler is an internationally respected plant pathologist with more than 30 years of experience in agricultural research in the developing world, most of them involved with rice. He has been the director general (DG) of the International Rice Research Institute (IRRI) for the last 10+ years—the second longest tenure after the Institute's founding DG, Robert F. Chandler, Jr. (1960-72). As DG, Bob set the Institute's strategic direction and he has also been a passionate spokesperson on a wide range of issues that affect rice growers and consumers worldwide.

Proclaiming himself an introvert, he gave this IRRI pioneer interview, conducted in his office at IRRI headquarters on 28 August 2015. With his customary wit and candor, he discussed his life both before and during his professional career, which has spanned time in Africa, Latin America, Asia, and the U.S. He retires in mid-December 2015.

The selected excerpts here are just the tip of the "riceberg." Much of the rest of Bob's 4-hour interview will soon be published online at http://ricetoday.irri.org. It features anecdotes about polar bears and all-meat dinners above the Arctic Circle, studying forest fires in Crater Lake National Park, what gives him goose bumps, and the wheels of the brilliant machine that is IRRI. He also gives frank opinions and views on a wide-ranging set of topics—including Golden Rice, IRRI's proud Filipino roots, the funding roller coaster, the plight of smallholder farmers, the role of women, the humbling experience of working with national programs, the Svalbard Doomsday Vault, climate change, growing up Catholic, advice for the incoming DG, and much, much more.

Agricultural beginnings on Pennsylvania dairy farms

When I was a kid, both my parents came from dairy farming families. My father's farm was in southeastern Pennsylvania; my mother's in the southwestern part of the state. I was mostly influenced by my mother's side of the family. They were pretty much very small dairy farmers, scraping to get by. I didn't realize that we were very poor. The men worked in the bituminous coal mines of Cambria County. They got up at 4 a.m., milked the cows, worked a full shift in the coal mines, came back to milk the cows again, and raised their families. That was the way things were; I thought this was normal. Those were my formative years, which instilled in me a deep

admiration for farming and the pride people take in their farms. That somehow rubbed off on me and that's something I've never lost.

A fourth grader's wish: to be a mad scientist

Science always grabbed my attention as a kid. I was probably just wired that way. I loved plants. My earliest memories are of me working with my mother. She always had a vegetable garden and I just loved it when the plants came up, especially the first flowers in the spring. It just gave me a sense of indescribable joy and a love of nature, life, plants, and gardens that I have to this day.

That led to a curiosity that transferred into science. I liked the 1950s' science fiction movies such as *The Killer Shrews* and *The Bride of Frankenstein*. And, there were the comic book superheroes such as Superman, Batman, and the rest. They had in them the good and the evil of science wrapped throughout. I took the good and thought it was exciting. This was pretty instrumental in shaping how I view the world. The mad scientist role was a career model. I could be a mad scientist!

Biology was mind-blowing

After my family moved from Pennsylvania to Illinois, I attended Urbana High School, where I was exposed to biology in a way that was just mind-blowing. I loved it. I really got turned on by science in an academic way, as opposed to the mad-scientist comic book/science fiction movies. It helped change how I saw things in the world.

Based on what I did in high school, I enrolled at the University of Illinois, where I ended up in an Honors Biology Program that really changed the course of my life. It was not the general premed biology class with 300 students: eight or ten of us were taught by four professors. I was attending a large land grant university with thousands and thousands of students. However, it was akin to a school like Harvard with small classes and outstanding teachers.

I took a plant ecology field trip to Mexico and was blown away again. I had never seen the ocean before. Mexico showed me a different culture with snow-capped mountains and tropical beaches. In the cities, I could drink beer even though I was only 20 years old. I didn't have to worry about an ID; fantastic food—my God, I thought I'd died and gone to heaven! I came back from that trip transformed.

My professors urged me to go into molecular biology, as that was the clear wave of the future. I thought about it, but the study of ecology better captured my love of nature. So, I did the opposite of what they advised! As a result, I joined the Peace Corps in 1971 and was sent to Africa—specifically, the very remote Congo (Zaire back then) because of my knowledge of French.

Peace Corps stint cultivates interest in plant disease

In the Peace Corps, I taught (in French) high school math, chemistry, physics, and biology at a little school, Collége Musim, in Bandundu Province about 200 kilometers north of Kikwit [arrow on map]. If you "Google" Kikwit, the first thing you find is the Kikwit strain of Ebola, which was 24 years after my time. I loved living in fascinating rural Africa.

A transformative event was an outbreak of bacterial blight that wiped out the cassava crop [the third largest source of food carbohydrates in the tropics, after rice and maize]. The main food for the people in my area was wiped out. This was causing local starvation. We had to close our school; there was not enough to feed my students. It really struck me that a plant disease, hitting a staple crop, could have such impact and nobody could do anything about it.

THE ZEIGLER FAMILY together for the holidays in Oregon (clockwise in front of Bob: wife Crissan, and children Claire, Nick, and Ali). Of Crissan, Bob says, "There is no way I could possibly have done what I did without her support and role as a tremendous sounding board." (Photo from Zeigler family archive)

Later, when I was a graduate student at Oregon State University, I took a forest pathology course; I wanted to study the interaction in the forest of dwarf mistletoe parasitism, fire, and pine forest community dynamics. This continued my turn-on to plant disease. The complexity of plant disease in ecosystems, my exposure to its impact on cassava, and the real eye-opening experience of living and working in a developing country [through the Peace Corps] all directed my career from then on.

No ambition to be a director general

It's funny. I never, ever had an ambition to be a director general. I, like most young, hungry scientists, loved nothing more than to make fun of the DG and to complain. My God, what we said: "Obviously, the director general does not know a damn thing; what is he thinking, etc." I was very much an iconoclast who felt that people in authority were pretty much incompetent and didn't know what they were doing. I made no secret about it and said it quite openly. Surprisingly, I still had a job [as a plant pathologist at both the International Center for Tropical Agriculture (CIAT) in Colombia and IRRI].

The first time the notion of being a DG was mentioned to me was in this office. I was giving my exit interview to Ron Cantrell [then IRRI DG, 1998-2004]. I was going off to Kansas State University to head the Plant Pathology Department. I didn't think I'd ever be back in an international center again. I thought I'd be moving into U.S. academia, focusing on agriculture there. Ron mentioned in passing that he saw a great future for me and, some day, I could even be sitting in this chair. I thought, "What, are you crazy?"

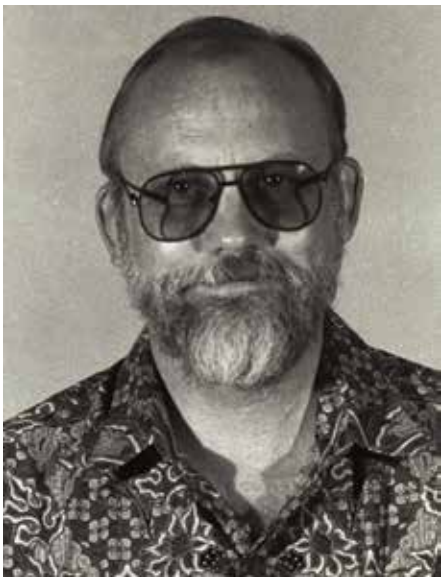
At that time [1998], CGIAR DGs were gods and I certainly didn't have any god-impression about myself. But, lo and behold, 6 years later, I was heading the CGIAR's Generation Challenge Program based at CIMMYT [International Maize and Wheat Improvement Center] in Mexico. There, a colleague who was a good friend of Ron Cantrell, told me that Ronnie was resigning from IRRI and that he and Bob Havener [former IRRI interim DG in 1998] said they thought that I'd be one of the strong candidates for the position. To make a long story short, it ended up being me. But it's something I never sought.

Not "one of the boys" anymore

I was certainly one of the boys when I was here [as plant pathologist at IRRI, 1992-98]. In those days, we had some wild, raucous times that will be best described by others.

There were advantages and disadvantages in coming back [as DG] after being away 6–7 years. An advantage was that I knew rice. I am the only director general of the Institute who actually has had a career in rice. I understood the rice plant; I understood the challenges around rice biology, agronomy, and crop protection. I've always had an interest in social sciences. I had an administrative career in rice at CIAT and at IRRI. I also had a pretty good appreciation of the culture of IRRI. I knew ALL of the tricks that people pull on senior management because I had pulled them all myself in previous incarnations. I had a good relationship with most of our partners across the region. I had a real appreciation for real potential for rice in Africa.

One disadvantage: I was friends with people [from the previous stint at IRRI] and that friendship could get in the way of doing my job—and that was really hard. I had to let people go who I used to play tennis with and socialize with. That's no picnic. Likewise, the direct expectations from me that people could draw on a past relationship to get favors done made me uncomfortable, to put it mildly. It was particularly hard for my wife. There were expectations that we could magically transform real problems or challenges at



ONE OF the boys at IRRI, circa 1993. (Photo by IRRI)

the Institute with the snap of a finger. One real education for me was how bureaucracies have a life of their own. More importantly, problems in an institution are never in isolation. Almost always, they are interconnected with more fundamental or structural problems. Hence, no quick fixes.

I tried my very best to make sure that the Institute itself, not the DG, is as sensitive and responsive as possible. One of the things I tried to do, and I hope I've been somewhat successful, was to take the personality cult, the "god" cult, out of the director: that we talk about the institution and not the DG.

National and international staff—wheels of a brilliant machine

I don't want to say anything that sounds like a platitude, but I don't think there is any question that the greatness of IRRI is due to its Philippine national staff (NRS). The contributions of the NRS are incomparable, just incomparable. IRRI discovered a model that I didn't fully appreciate until last year (after 9 years of being DG and 7 years additional as scientist in the past). IRRI created and discovered this model completely by accident. I was reviewing with Christine Croombes [director of IRRI's Human Resource Services] our staff profiles. We noticed that the turnover time of international staff (IRS), on the average, is about 7 years and turnover time of the NRS is closer to 20 years.

It just clicked in my mind that we have a machine that is moving forward with different parts turning at different speeds in that we have IRS turning at a much faster rate, bringing in new thinking from outside via postdocs and entry-level scientists. They come for 7 years or so and move on—maybe they come back later, maybe they don't. They come in, constantly injecting new ideas.

We have another part of the machine that is turning over much more slowly. It's taking up that knowledge and innovation that is coming in from the young international scientists, but containing and retaining the past experience and accumulated knowledge. That system—of interaction and timing involving the NRS having the institutional memory, the experience, the knowledge of the historical nature of an experiment, and the context within which we are working and constantly interjecting and interacting with new scientists coming onboard—is a brilliant model of renovation, rejuvenation, and conservation. You couldn't have designed a better system. But it wasn't designed; it was pure luck. But it is a brilliant, brilliant mechanism. Among so many other things, this explains much of IRRI's great success. It's that contribution, the commitment, the devotion, and the longevity of the NRS with the excitement and innovation of new IRS coming and going. It's quite a feat and I'll have to think about it some more and get some numbers behind it and maybe write it up.

As I said, this is an insight that hit me just a year ago. It's like one of those blinding scientific discoveries—you go, "oh,, of course," it is so obvious, but know nobody has said that before. That nature of IRRI and its success utterly depend on that model. But that model would never work without the Filipino culture, its tremendous work ethic, tremendous loyalty, tremendous sense of family, and tremendous sense of community and commitment.

Greatest challenges as IRRI chief

Convincing donors to contribute. One strength is the unassailable nature of IRRI's mission. Keeping in mind what IRRI is about, why we're here, our track record, and our ability to contribute made dealing with the challenges much easier. There are the usual challenges: one—making sure that the money comes in. I still love explaining to donors how important rice is and what IRRI's role is in the future of the world and what we have to contribute.

CGIAR nightmare. The CGIAR brings out the worst in people. Some people you deal with one on one are really nice, serious, and dedicated. But, when you get them into the context of the CGIAR, they're just horrible, myself included. I think I turned into the meanest SOB you'd never want to meet when I put on my CGIAR hat.

I never thought about it in those terms until right now. This morning, I had to write a message related to

DR. ZEIGLER amidst the wheels of a brilliant machine–the IRRI staff. (Photo by Enrico Mercado, IRRI)

the CGIAR that I didn't want to write. I just find myself, in many cases, having to deal with people who somehow survived in positions way beyond their capacity. It's just one endless stream of frustrations. That's a real big challenge—to stay positive and keep IRRI working and moving forward in the CGIAR environment, which in many cases is toxic.

Being an introvert. There is the challenge of me being an introvert. I am generally happier by myself. People may be surprised about that, but I'm a very strong introvert. Meeting the challenge of being outwardly projecting was something I had to learn, including being gregarious and dealing with people in social situations. Handling difficult personnel problems was always a big challenge for me.

Discovery—one of the greatest joys

Oh the discovery! Realizing that you found something new is a thrill that can't be described. I've worked on hoja blanca virus, bacterial pathogens, the *Pseudomonas* complex, and blast disease. In each, I like to think I made some significant discoveries and advances. The realization, when it hits you—that you have an insight that explains something that was unexplained before—there's nothing like it. It's a rush, I mean goose bumps; hair stands on end! It's just a thrill. I think any scientist will tell you that ecstasy of discovery—of enlightenment—when you have that flash of understanding—is indescribable. I had a few of those and, my God, they're something else. Personally, it takes your whole being to a new level.

As a director general or research manager, I found it equally exciting to take pleasure from other people's discoveries and breakthroughs, be it the *SUB1* gene [for flood tolerance], advances with C_4 rice [transferring the photosynthetic efficiency of maize into rice], or new information coming out of our long-term trials [Long-Term Continuous Cropping Experiment].

No apologies for the Green Revolution

I believe that those who developed the modern rice and wheat varieties in the 1960s and '70s and then recommended routine pesticide applications, etc., did not know that they were advocating bad practices. In that sense, an apology is not necessary. You make an apology for things that you do wrong when you knew they were wrong. And you judge the actions of people in the context of their time. We certainly openly recognize it was a mistake and we have learned from it.

If you look at how IRRI's research program has evolved from that learning, early on, we started to question the impact of those early Green Revolution practices and took corrective action. This resulted in ground-breaking studies on the

DR. ZEIGLER visits farmers' fields around the world to interact with the ultimate partners in the private sector. Here, he diagnoses what disease might be afflicting a smallholder's crop near Ubon, Thailand. (Photo by Gene Hettel, IRRI)

IN THE TRANSGENIC screenhouse at the Bangladesh Rice Research Institute in Gazipur, Dr. Zeigler confers with Bangladesh national program researchers on the latest work on Golden Rice in the country. (Photo by Gene Hettel, IRRI)

biosphere within the rice paddy, arthropod complexity, and the impact of insecticides.

Do we regret? I don't know. It was a different time and place. It's pretty hard to second-guess these kinds of things. Apologize? No! Recognize that those practices were destructive to the environment? Absolutely. Make sure that the same thing doesn't happen again? Absolutely. Be watchful and vigilant of those who misuse tools for short-term gain? Absolutely.

IRRI's big challenge

The big challenge will be how we relate to the private sector. There's no question that the private sector is increasingly interested in rice and it's going to be our challenge to maintain our public institution persona while taking advantage of the situation. I think it's our job to co-opt and help direct the way the private sector moves in a way that the maximum number of people benefits—the small farmer, medium-sized farmer, poor middle class consumers—all of them will benefit from IRRI's work. We have the ability to manipulate how the private sector interacts. We have the ability to help countries come up with policies that maximize the impact of our work. That's the challenge of the Institute.

I'm quite optimistic that the Institute will continue to be relevant and when I take my last breath—whenever that is—IRRI will still be a strong and relevant institution. These are exciting times to be a part of IRRI, be a part of rice research; no doubts in my mind about that. I've been UNBELIEVABLY fortunate to have been a part of IRRI for almost 18 years. For seven of them, I had a real job as a scientist. And over 10 years as director general, I consider that a blessing. How I came to achieve it or deserve it, I'm not going to ask any questions, but I'm deeply grateful for the opportunity.

Being at the helm of IRRI—no other job like it

The IRRI experience is number one in my career—without a doubt. The job as IRRI director general is unlike any other job you can ever possibly want. Science, its value in human terms, the impact you can have positively on the environment—you can transform the way the whole planet will function decades from now, a century from now. What happens at IRRI is relevant.

My God, you can't ask for anything better or more humbling. If you are at IRRI and you work hard, do your best, you will never have to worry about wasting your life. Every morning, when you look in the mirror, you won't regret what is looking back at you. That's worth a hell of a lot! ■

After 22+ years at IRRI, Gene Hettel, editor-in-chief of Rice Today *and IRRI historian, also retires shortly after Dr. Zeigler.*

RICE SECURITY IS FOOD SECURITY for much of the world

by Mary Brolley

A lifelong interest in Asia has propelled a business model and value chain specialist for the International Rice Research Institute (IRRI) into a meaningful career as a consultant on food security. He now helps farmers in the developing world devise ways to safeguard their crops after harvest.

His high school counselor suggested that he go straight into science or engineering. But Alfred Schmidley, a 1985 graduate of Bradley University in Illinois, was in no rush to make such a decision and would soon consider other ideas. "When I went to college, the world around me suddenly got a whole lot bigger—with some apprehension, mind you, as I began trying to fill in all the gaps," he recalled with a laugh. "I found it all very complicated!"

Finding an international niche

A native of Beloit, Wisconsin, Mr. Schmidley transferred from a state university to Bradley, where he found class size and the faculty more welcoming. Interested in global issues, particularly Asia, he soon met John Howard, then director of the International Studies Program, now professor emeritus. "Dr. Howard was very approachable and supportive," reminisced Mr. Schmidley. "As soon as I met with him, I realized that Bradley might be small in size, but it came with some really big perspectives about what I could explore academically. International studies seemed right for me."

Another favorite Bradley faculty member was Dr. Robert Fuller, Caterpillar Professor of philosophy and religious studies, and perhaps a major reason why Mr. Schmidley lives and works in Asia today. "He was inspiring because he brought new perspectives—of people and culture—into the classroom. "*Religions of the East* was one of my favorite courses," Mr. Schmidley recalled. "This influenced me to backpack my way across Asia after graduation—before taking up Asian languages and related studies in graduate school."

While at Bradley and busy with international studies, he found the time to plunge into dormitory life, eventually becoming a resident assistant. Apart from the financial assistance, it was a great way for him to meet people, both students and others associated with the university community. He supervised freshmen in all-male dorms.

"Freshmen floors assigned to resident assistants were seen as more challenging," he added with a smile. "In hindsight, this provided me with a lot of formative experience in people management. I learned to deal with all sorts of people in many different situations."

Narrowing the focus: working with Asia's rice farmers

After completing postgraduate business management and language studies, and working more than two decades in Asia, Mr. Schmidley is currently a business model and value chain specialist for IRRI, where he happily combines his interests in Asia, business management, and rural development. Since joining the Institute in 2009, he has worked to help developing country farmers improve their food security, particularly in rice.

MR. SCHMIDLEY inspects grain on the ground after harvest. Crop losses occur at every point in the process, from harvesting, transport, processing, and storage — all the way to market. (Photos by IRRI)

Rice? Yes, that's right. Rice is the main staple food for most countries in Asia (and increasingly in Africa). Any threat to this cereal crop can jeopardize global food security and put millions of people at risk of malnourishment or even starvation. An increasing world population means that rice production must increase by 114 million tons by 2035, but farmers must achieve this on a decreasing amount of available agricultural land and under significant threats from climate change. A "second" Green Revolution has been called for, and, in fact, in the views of some, has already been under way for several years.

"Green Revolution" is the name given to a series of innovations in agricultural research and technology development that started in the 1960s. This effort increased agricultural production worldwide, especially in the developing countries of Asia. IRRI, established in 1960, championed the scientific advances in rice research that would ultimately reduce poverty and hunger, especially prevalent at that time in much of Asia.

Mr. Schmidley's specialty at IRRI is working downstream to develop sustainable business models for the adoption and delivery of new technologies to farmers. This includes postharvest, when preventable losses of 25% or more result from not getting rice and other crops out of the field and processed in a timely manner. If these losses are not prevented, many poor farm households will be robbed of both precious food and income.

After harvest, risks continue

It is risky enough to get a rice crop to the harvest stage. From actual harvest and beyond, the risks continue. Once the paddy (or "raw rice") is ready for harvest, it should be cut and removed from the field for threshing, drying, and safe storage, ideally within 24 hours. But all too often, there's a shortage of labor or a lack of efficient technology to achieve this. This results in physical grain loss and loss of grain quality to farmers, among others in the rice production chain. In many developing countries, harvest and postharvest operations are done by hand, often by women. All the required operations are difficult to carry out in a short time and so the harvested rice crop often becomes wet and rots or is eaten by pests.

GUIDED BY a local nongovernmental organization, members of a women's self-help group in Bihar, India, take up open-drum threshing. The women tend to their own families' threshing first, then hire out their services to earn income.

Farm mechanization in Asia—a great opportunity

Before joining IRRI, Mr. Schmidley worked for Briggs and Stratton Corporation, a Wisconsin-based small engine manufacturer, where he held many business development postings in Asia. In this dynamic region, he found that a great need for agricultural mechanization provided many new business growth opportunities. China and Southeast Asia became his major focus aided by his post-Bradley Chinese language studies and an MBA from the University of Queensland in Australia.

"Asia is an extremely diverse region," explained Mr. Schmidley. "Finding new market opportunities to help farmers mechanize really captured my imagination." It was during this time that he began experimenting with cross-sector partnerships and more holistic system innovation models for creating value and capturing opportunities for farmers and other agricultural sector players.

"The traditional way of marketing in developed Western countries is very linear, in which one offers products and delivers them through an established distribution network to customers," he said. "In developing countries and emerging markets, however, this structure generally does not exist or it is immature. In addition, the end users are not aware of their options." This requires more creativity and harnessing of knowledge and resources from government agencies, research institutes and universities, and NGOs for raising awareness about new opportunities among farmers and industry players.

Working with "resourceful and innovative" farmers—a joy

"Lessons about the need for cross-sector collaboration helped me prepare for my current role at IRRI," Mr. Schmidley said. Now,

IRRI's RESEARCH participatory learning approach begins with community engagement—enabling villagers to identify postharvest problems of interest and crafting possible management solutions for them.

his business model approach at IRRI involves platforms called "learning alliances"—groups of public, nongovernment, and private sector interests that, along with farmers, work together to improve food security and livelihoods in agriculture. The typical target is a smallholder rice farmer, someone who farms a hectare of land or less.

"Farmers by nature can be very resourceful and innovative because many have so little to work with," he said. "Give them sufficient knowledge and access to technologies to choose from and they'll define what they need." However, successful outcomes require a whole "business system"—including farmers, agricultural extension, and industry—to function better by fostering learning among these different parties to support local needs and sustainable development of markets.

In India, a primary target for this approach has been self-help groups (SHGs) made up of women. Here, women farmers are organizing themselves to aggregate resources for solving identified problems and exploring their solutions. This makes sense since women are increasingly involved in farm work, including postharvest processing, because the men are, more and more, taking up work in cities or nonfarm sectors. Up to now, women had often been seen as having little economic value as they were involved mostly in the drudgery of household-level processing. However, this is changing and Mr. Schmidley's business model approach is now treating the entire farm family as a business unit.

For example, a little more than a year ago, researchers who are part of the Cereal Systems Initiative for South Asia (CSISA), funded by the Bill & Melinda Gates Foundation and USAID, started working with NGOs and the SHGs in Bihar, India. Bihar is regarded as one of the country's poorest states. Farmers were incurring huge postharvest losses because of delays, a lack of labor during the peak harvesting period, and little awareness of options.

"Through local NGOs, we helped pilot and train the SHGs about basic options for mechanical threshing that both reduced delays and prevented losses," said Mr. Schmidley. "We also provided them with potential business opportunities for offering contract services to other farmers in need. Our business model showed that the savings to farmers more than offset the cost of services, not to mention that it recovered much more rice from the farmers' harvests."

However, this required a longer process of learning about various options and adapting them to meet local needs. In Bihar, several options were tested in a participatory fashion using this learning platform, involving local machine fabricators and government and nongovernment agencies. "In the end, we came up with an improved version of a basic threshing machine by adding wheels and a handle so it could be moved from farm to farm over muddy fields to aid in these income-generating services," Mr. Schmidley said. The initiative has been such a success that other SHGs now operate their small businesses by providing services or renting a threshing machine to small-scale farmers in the region.

Bradley helped me get to this stage

"My current goal in all this is simply to help poor farmers get more rice out of their fields and into rice bowls around Asia," concluded Mr. Schmidley. "Looking back, my Bradley experience was very formative to what I'm accomplishing at this stage of my career. The broad-based education I received at the university allowed me to explore a world of opportunity and challenges. It helped me lay a solid foundation for the many exciting things I've achieved and experienced in both the private and public sectors." ■

Ms. Brolley is assistant director of Marketing and Publications at Bradley University. Printed with permission by Bradley University, this story is based on a feature that appeared in the Summer/Fall issue of Bradley Hilltopics.

BIHAR FARMERS getting more rice out of their fields.

DR. MYO Aung Kyaw (center, standing), IRRI consultant, explains to farmers how the flatbed dryer works. Dr. Kyaw also spearheaded the training of dryer operators to ensure proper use and maintenance. (Photo by Christopher Cabardo, IRRI)

LEARNING ALLIANCE: a coalition for change

by Reianne Quilloy, Rica Joy Flor, and Rona Rojas-Azucena

Millions of Asian rice farmers struggle with low-quality grains, which are brought about by poor postharvest management, inappropriate technology, and a lack of understanding of the factors that affect rice quality. These problems result in a loss of potential income for farmers and lesser available rice in the market.

The Learning Alliance is a way for actors in a rice value chain to work together and encourage cooperation to increase adoption of technologies, facilitate stronger partnerships, and use resources sustainably. Through the Learning Alliance, IRRI facilitates a network of stakeholders in the context of improving rice postharvest management. The Alliance in Myanmar, composed of local farmers and IRRI's local partners from the rice value chain, aimed to produce better-quality rice and sell it to larger markets. Before it started in Myanmar, the method was also used in various Southeast Asian countries where value chain actors similarly sought to improve their country's postharvest systems.

To reach U Aung Kyi's rice farm takes 45 minutes by boat from Bogale Township to Kyee Chaung Village, situated along the Ayeyarwady River. This river, the country's main waterway, serves as a trade thoroughfare connecting villages along the delta with large markets such as Yangon. In the past, U Aung Kyi sold his sun-dried paddy to a village trader who offered a low price only. Every rainy season made him worry that his grains would not dry in time and would eventually deteriorate. Even worse, severe weather conditions threatened the loss of his entire crop. His problem resonates with thousands of other farmers in Southeast Asia, who face threats to food security and limited opportunities to obtain a higher profit because of inefficient technologies and the poor quality of rice grains.

Now, U Aung Kyi stands in a small room in Bogale Township, with about 20 more people, sharing how he was able to sell good-quality paddy at a higher price in Yangon. "During the monsoon season in 2014, my paddy was very wet so I dried it using the flatbed dryer that IRRI, PPHDG (Pioneer Postharvest Development Group), and GRET (Professionals for Development) established in Kyee Chaung Village," he said. "I used the dryer again the next season. I was able to obtain better quality paddy and sold it at the Yangon market."

The flatbed dryer is a tried-and-tested technology from Vietnam that IRRI helped introduce in Myanmar to reduce postharvest losses.

The gathering in Bogale Township started from a participatory impact pathway analysis (PIPA) workshop organized by IRRI in December 2013 through the Livelihood and Food Security Trust Fund (LIFT) project of the United Nations Office for Project Services to bring the rice value chain actors in the Ayeyarwady Delta together. These actors had a shared interest in improving the postharvest systems of farmers by using the flatbed dryer. Toward the end of the workshop, the participants, which included two international nongovernment organizations and one private-sector company, agreed to establish a village-level Learning Alliance (LA) around the flatbed dryer to help farmers in Kyee Chaung and nearby villages improve their grain quality and, in due course, their income.

An innovative way of learning and working together

The partnership quickly realized that raising quality and profits would require changes not only for farmers, but also for many stakeholders along the rice value chain. The LA is a platform for multiple stakeholders—in this case, actors in the rice value chain—that encourages collaboration among them to tackle a complex problem for which they have a common interest. In Myanmar, for example, traders want to buy high-quality paddy to maximize profits, while farmers want to obtain higher prices for their crop and reduce postharvest losses to increase income. The LA provided a common ground for farmers and traders, together with researchers, government extension staff, NGOs, millers, and other service providers, to discuss strategies and find incentive mechanisms. The LA facilitated discussions on various issues concerning ownership, capacity building, and linking farmers to reputable markets that provide premium prices.

The case in Myanmar is just one example of how the LA works in improving postharvest systems in Southeast Asia. The concept of the LA was introduced at IRRI in 2009. The LA uses participatory approaches, which help representative stakeholders in rice postharvest to plan, implement, and share resources with the goal of producing high-quality grains with minimal postharvest losses.

"We need a flexible platform in which we can bring these different value chain actors together," shared Martin Gummert, IRRI postharvest senior scientist. "The LA enables farmers, traders, millers, the private sector, scientists, and other implementing partners to work together toward a common goal, and IRRI serves as the facilitator of the process. We have the technology, in this case a dryer that serves as an entry point to overcome a problem, such as poor grain quality; then, we facilitate learning about its use and how to sustain it, together with partners who share a similar goal and would have the resources for complementary initiatives."

After the dryer was established, GRET and Welthungerhilfe (WHH) immediately organized the community groups to coordinate the use of dryers in the village and established the "dryer committee" to ensure proper and sustainable operation of the dryer. They also provided warehouses where farmers could store their grains after drying and sell them when the market price was more favorable. PPHDG, on the other hand, provided technical backstopping for dryer operators to ensure that the dryer was used and managed properly.

FARMERS FROM Bogale and other townships visited the Wardan Wholesale Market. In this activity, farmers realized that Bogale rice obtained the lowest price in the market because of its poor quality. (Photo by Reianne Quilloy, IRRI)

Plan, act, reflect

The LA is characterized by iterative learning cycles by different small groups in the network. A key part of a learning cycle involves a facilitated reflection activity on what happened, what they experienced, and what resulted from it for future planning and implementation. Then, the results of reflection activities feed into subsequent learning cycles, which allow farmers to identify other emerging concerns. U Aung Kyi is a member of the village-level LA that tested whether using the flatbed dryer could result in good-quality rice and whether such rice could be sold for a higher price.

Established in Cambodia, Vietnam, and the Philippines, these IRRI-facilitated alliances led to notable outcomes, such as the commercialization of the IRRI Super Bags in the Philippines (see *IRRI Super Bags now commercialized* on page 7 of *Rice Today* Vol. 11, No. 4), the use of combine harvesters in Cambodia (*Machines of Progress,* on pages 38-41 of *Rice Today* Vol. 9, No. 3), and laser leveling in Vietnam (See Laser-*guided dreams* on pages 28 -29, Vol. No. 4, of *Rice Today*). Aside from these, better capacity of stakeholders, improved practices, and social arrangements have emerged to support innovation in the communities.

Bringing the learning further

Currently, the Closing Rice Yield Gaps in Asia with Reduced Environmental Footprint(CORIGAP) project, which is supported by the Swiss Agency for Development and Cooperation, continues to venture into how multistakeholder processes can be best used in other parts of the value chains in six rice-growing countries across Southeast Asia, including Myanmar. Similarly, the MyRice project of the Australian Center for International Agricultural Research also conducts LA activities in Myanmar, which targets improving smallholder farmers' profitability and productivity of rice-rice and rice-pulse cropping systems.

Learning topics vary in different countries because initial Alliance members identify different problems that need immediate attention, such as reducing environmental footprints or the sustainability of rice production. The most important thing is that beneficiaries can identify their need, and they can find a

THE 4-TON dryer in Kyee Chaung Village, Mawlamyineyagyun Township, was established by the Pioneer Postharvest Development Group, with support from IRRI, GRET, WHH, and other NGOs. (Photo by Christopher Cabardo, IRRI)

common ground that the CORIGAP and MYRice project can help address.

"The formation of the Alliance is not just about the farmers or end-users learning about the technology; it is also a learning process for us, as scientists and implementing partners, on how to work harmoniously toward a more targeted change for the community," explained Engr. Gummert.

U Aung Kyi and the Alliance members recognize the importance of having the dryer in their community, though they know that sustaining its use and building market models around it is still a work in progress. "We find it difficult to encourage other farmers to use the dryer," shared U Zaw Minh Htike, another LA member.

Recognizing this challenge, the members started an information campaign by designing print materials explaining the benefits of using the dryer. The information was presented in the form of a traditional poem. "This is to convince millers and traders to buy grains that were dried from the flatbed dryer," said U Zaw Minh Htike.

On the back of a flyer they produced, he points to an image they conceptualized of three interlocked hands. He tells the Alliance members, "All of us should be partners: farmers, traders, and millers. We should work together to produce high-quality grains, and maybe, someday, bring Myanmar rice to the export market."

With that in mind, and having learned the importance of producing high-quality grains and selling to markets that command a higher price, the group knows that this is just the beginning and their vision is bound to come to fruition soon.

U Aung Kyi, U Zaw Minh Htike, and their fellow LA farmer-members are now armed with the knowledge on how to obtain good-quality grain, on how to reach larger markets to sell their grain, and on who needs to become involved to realize their vision. The road may still be a rough one ahead, but they know they now have the solutions to make it happen.

The joint learning process brought about by PIPA and the LA provided more than a working technology that they could use. It improved the capacities of rice value chain actors and provided an enabling environment for them to explore ways of working together and with other interested groups. Through this, farmers realize that they can be active value chain players who have a hand in the profit they can make from their harvests. The inclusive learning approaches also brought in new and trusted allies for these rice value chain actors who share a similar goal of putting Myanmar back into the rice export market. ■

Ms. Quilloy is a communication specialist with the IRRI Postharvest Unit and Learning Alliance facilitator, Ms. Flor is an IRRI scholar, and Ms. Azucena is a science communication specialist.

U AUNG Kyi has tried using IRRI's flatbed dryer and saw a marked improvement in grain quality. (Photo by Reianne Quilloy, IRRI)

The ongoing transformation of rice farming in Asia

by Samarendu Mohanty, Humnath Bhandari, Bidhan Mohapatra, and Sampriti Baruah

Rice farming in Asia is dominated by millions of small farmers with an average landholding of 1 hectare. Traditionally, both male and female family members have been involved in rice farming. However, strong economic growth in Asia in the past two and a half decades has led to rapid outmigration of rural youth in search of better economic opportunities.

This has resulted in an increasing number of elderly people and women left behind to take care of farming. For example, the average age of rice farmers in the Philippines increased from 44 in 1980 to 58 in 2011 while the average age of rice farmers in Bangladesh increased from 44 in 1988 to 51 in 2011.[1] The traditional role of women in rice farming, which is somewhat dictated by farming practices and sociocultural norms across countries, is also changing across Asian countries. In general, women are mainly involved in establishing the crop, harvesting, and postharvest activities while men lead in preparing the land, managing the crop, operating farm machines, and marketing. With the migration of male members of the household, the women are taking over the role of farm managers and decision makers. This is reflected in the rise of women farm landholders all across Asia, with striking increases in Nepal and Thailand in the past two decades. Based on the Gender and Land Rights Database published by FAO, the share of women's agricultural landholding in Nepal made a quantum leap from 8% to 19% between 2001 and 2011. Similarly, Thailand witnessed a big jump in women's agricultural landholding from 15% to 27% between 1993 and 2003 (see *Women rising* on pages 42-43 in *Rice Today* Vol. 13, No. 4).

Apart from rural outmigration, rising nonfarm opportunities in rural areas that account for 40% of total rural employment are making agricultural labor shortages even more acute in Asia. The increasing labor scarcity has led to a rapid rise in wage rates in the past decade in almost all Asian rice-growing countries. The rate of increase accelerated after the mid-2000s for major rice-growing countries such as China, India, Bangladesh, Indonesia, and Vietnam. According to Steve Wiggins and Sharada Keats in their 2014 report on *Rural Wages in Asia*, the real wage rate in China increased by more than 90% between 2003 and 2007, by 35% for India between 2005-06 and 2012-13, and by 45% for Bangladesh between 2005 and 2010. Similarly, in Indonesia, the real agricultural wage rate in 2009 was 50% higher than what it was in the first half of the 2000s.

Rice farming transformation

Since rice farming in Asia is traditionally labor-intensive, and with labor costs accounting for 45% of the total cost of production, farmers have been quick to explore the possibility of replacing labor-intensive activities such as land preparation, transplanting, harvesting, and threshing with appropriate mechanization to lower the fast-rising cost of production. Small-scale farm mechanization

Ms. Chalao Auncharoan from Suphan Buri, Thailand with her three combine harvesters. (Photo by IRRI)

[1] IRRI farm household database.

and custom-hiring arrangements with machines are fast evolving as viable solutions for smallholder rice farmers in Asia. Apart from male service providers, many women and youth are finding it attractive to enter the service provider business for land preparation, transplanting, harvesting, and threshing.

These service providers cover several hundred kilometers in a season, taking advantage of the differences in planting and harvesting period among different regions. In India, the service providers start from Punjab and Haryana in the northwest as they harvest their crop early. Then they move toward the southeast through Uttar Pradesh, Bihar, Odisha, and West Bengal, covering nearly 1,000 kilometers in a season. Similarly, combine harvest service providers in Thailand start from the Central Plain and move to northeastern Thailand, covering more than 800 kilometers in a couple of months.

The rate of mechanization varies widely from country to country and also among different rice-growing ecosystems within the same country. The extent of mechanization is much greater in the intensive production systems such as northwest and southern India, the Mekong Delta of Vietnam, and the Central Plain of Thailand than in the rainfed production systems of eastern India and northeastern Thailand. However, rising rural labor outmigration and wage rates in unfavorable rice-growing regions are accelerating the pace of mechanization. It is just a matter of time before mechanization covers the majority of rice areas in Asia, particularly in land preparation, transplanting, harvesting, and threshing.

To offset the unviability of mechanization for smallholder farmers, several models of virtual land consolidation have started to emerge in different parts of Asia. The "Small Farmers, Large Field" model in Vietnam, which allows small farmers to benefit from economies of scale by pooling their small farms into large fields of 50–500 hectares to lower the per unit cost of using farm machinery, such as combine harvesters, is becoming popular among small farmers.

Similarly, an industrial rice farming scheme introduced by the Suphanburi Rice Millers Association in collaboration with Suphanburi Rice Research Center has convinced the farmers to grow one variety with synchronized planting and harvesting time on around 400 hectares. The idea is to lower the harvesting cost of USD90–100 per acre by 20–30% by providing service providers with a bigger contract for custom harvesting.

Small farmers in many parts of Asia are also renting additional lands that are available because of rural outmigration. With additional land coming through rental arrangement, Gagan Bihari Pradan, a small rice farmer in the eastern Indian state of Odisha featured in a *Rice Today* article (see *A day in the life of an Odisha rice farmer* on pages 40-41, Vol. 11, No. 4), now farms 2.5 hectares compared with 1 hectare in 2012. This allows farmers to modernize their farm operations through the use of mechanical transplanters, combine harvesters, dryers, threshers, etc.

Aside from mechanization, farmers in many parts of Asia are changing farming practices in response to rising wage rates, increasing water scarcity, and higher incidence of extreme weather by moving from labor-intensive transplanting to direct-seeded rice, changing irrigation practices from flooding to alternate wetting and drying, and adopting stress-tolerant varieties.

What lies ahead

The emerging Asian economies are expected to march ahead on the back of the increasing consumption of the growing middle class population, which is projected to reach 3.2 billion in 2030 compared with 525 million in 2009 (Fig. 1). During the same period, Asian per capita income is expected to increase sixfold to reach Europe's current per capita income.[2] Asia's five largest rice economies (China, India, Indonesia, Thailand, and Malaysia),

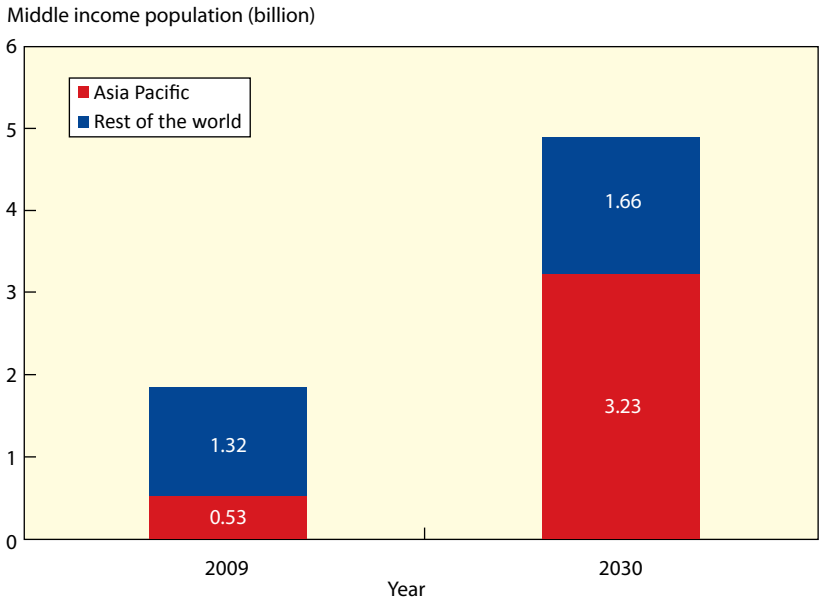


Fig. 1. Global middle class population growth.
Source: Kharas (2010).

[2] ASIA 2050: Realizing the Asian Century. 2014. Asian Development Bank.

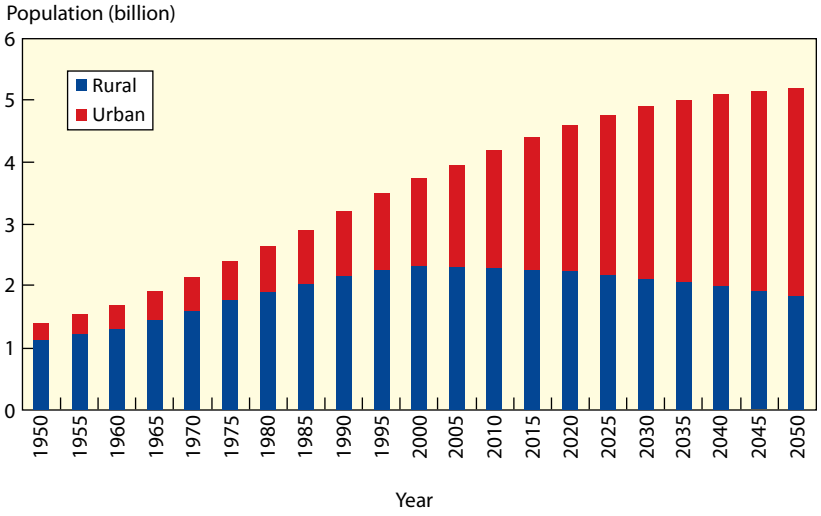


Fig. 2. Urbanization trends in Asia.
Source: UNDESA (2014).

which account for nearly 65% of total global rice production, are expected to lead Asia's advance to prosperity. Other emerging Asian economies such as Vietnam and the Philippines, where rice is extremely important in terms of both food security and livelihood for millions of small-scale poor farmers, are also expected to join the bandwagon of prosperity. These seven countries also dominate the international rice market, with Thailand, India, and Vietnam as the three largest exporters, and China, Indonesia, Malaysia, and the Philippines as the dominant rice importers.

The growing urbanization with more than doubling from 1 to 2.1 billion between 1990 and 2015 is expected to rise in the future with continued strong economic growth and better economic opportunities outside agriculture and the rural sector (Fig. 2). The urban population is expected to reach the level of rural population by 2020 and further grows to account for nearly two-thirds of the total population by 2050 (3.3 billion urban vs 1.8 billion rural).

Income growth, urbanization, and other long-term socioeconomic transformations are likely to continue to influence the composition of the food basket in the future. Normally, one would expect diversification of the food basket to include more high-value products such as meat, dairy products, fruits, and vegetables as income rises. At the same time, people will also be shifting from low- to high-quality rice and will consume rice as a processed product rather than as a grain.

Packaged rice is becoming increasingly popular in cities because of its convenience. In 2012, India was the most active in this sector, with more than 50% or 200 packaged rice product launches in Asia, followed by Vietnam and Thailand, which accounted for 10% and 8%, respectively (source: Mintel.com). The overall size of the packaged rice market in India was 2 million tons in 2012 compared with 1.2 million tons in 2012, an increase of 66% in two years.

Urban consumers are also becoming more attuned to branding and label claims. Rice with various label claims such as rice with low glycemic index for people with diabetes, rice with high dietary fiber and mineral, rice with high antioxidants, vitamin A-enriched rice, and many others are now prominently placed in supermarket shelves. As consumers become more familiar with branding, some proportion of rice sales is expected to move from supermarkets to online trade. Amazon in India now sells branded basmati and nonbasmati rice online for home delivery. One would expect similar trends in other Asian countries soon.

As people juggle their fast lifestyle in cities, the preference for easier and more convenient cooking-food products will continue to rise in the future. To cater to this segment of consumers, ready-to-eat microwavable rice boxes have started appearing on supermarket shelves. The recent purchase of Tilda, the Indian basmati milling and export company, by the U.S. food group Hain Celestial, which plans to link the Tilda brand with its existing distribution channel and bring basmati and ready-to-eat rice to the western world, is just the beginning of such integration and consolidation in transforming the rice sector into a market-driven value chain.

These changes at the consumer level, labor shortages, and rising wage rates are expected to shape the farm-level transformation in terms of mechanization and vertical integration. Small farmers will be forced to mechanize rice farming and achieve scale by participating in innovative new models of land pooling and consolidation. The end result will be moving toward modernization and commercialization of rice farming that is sustainable and vertically integrated along the supply chain. ■

References

ADB (Asian Development Bank). 2011. Asia 2050: Realizing the Asian Century.

Kharas H. 2010. The emerging middle class in developing countries. Working Paper No. 285, OECD Development Center.

United Nations Department of Economics and Social Welfare (UNDESA). 2014. World Urbanization Prospects (2014 revision).

Wiggins S, Keats S. 2014. Rural wages in Asia. Overseas Development Institute Report.

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GRiSP partners in Asia

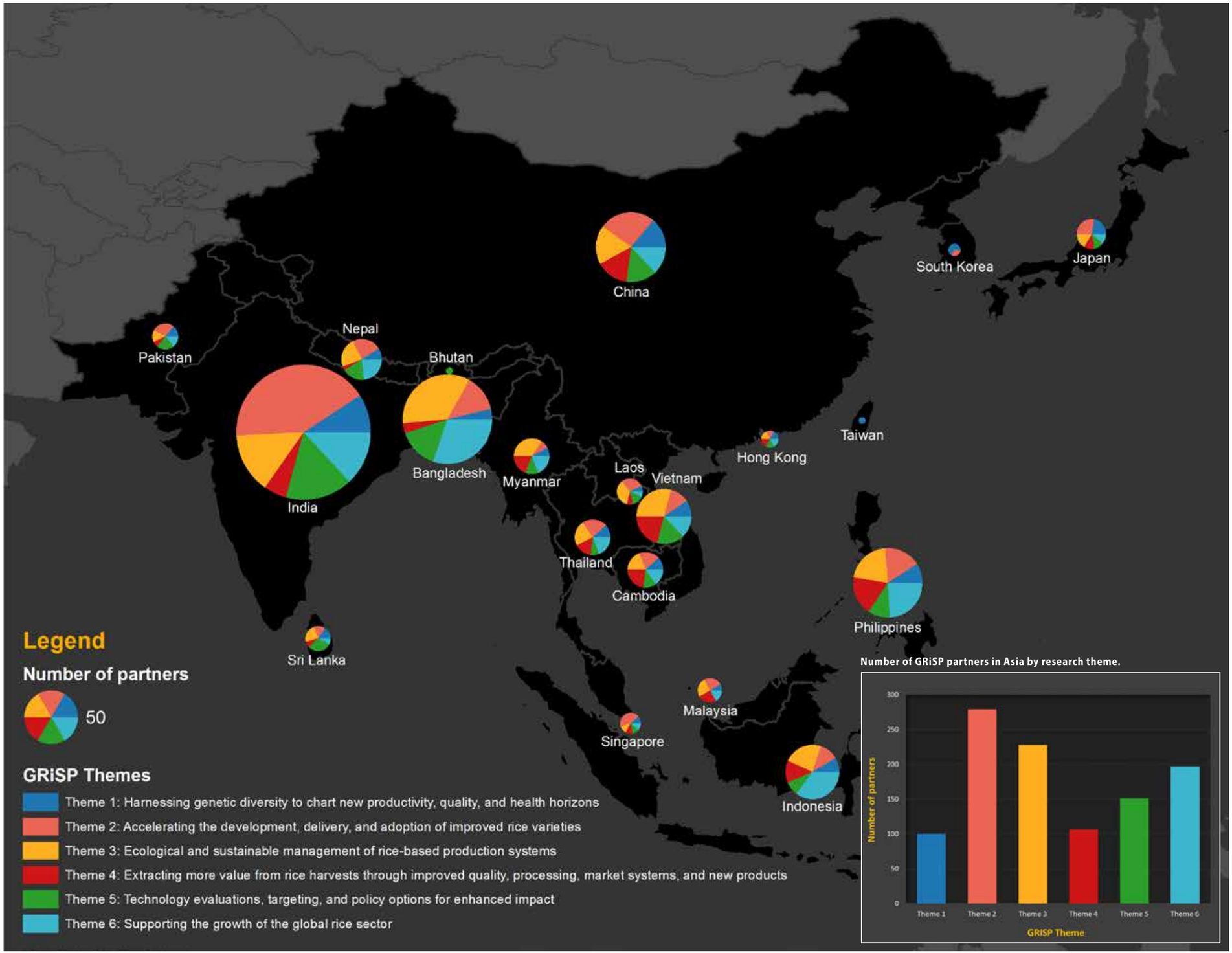
by Neale Paguirigan, Alice Laborte, and Bas Bouman

The Global Rice Science Partnership (GRiSP) is a strategic plan for impact-oriented rice research for development (www.grisp.net/). The partnership is led by the International Rice Research Institute in collaboration with founding partners the International Center for Tropical Agriculture, the Africa Rice Center, Japan International Research Center for Agricultural Sciences, *Centre de Coopération Internationale en Recherche Agronomique pour le Développement* (CIRAD), and *L'Institut de Recherche pour le Développement* (IRD).

GRiSP brings together more than 900 partners globally to address the shared goal of reducing poverty and hunger, improving human health and nutrition, reducing the environmental footprint, and enhancing the ecosystem resilience of rice production systems.

GRiSP has more than 400 partners in Asia, where about 90% of the world's rice is produced and consumed, contributing to six research themes: (1) genetic diversity, (2) better rice varieties, (3) rice and environment, (4) value-added rice, (5) policy and markets, and (6) knowledge and capacity building (see map).

More than half of its partners are in South Asia, with India and Bangladesh having the highest number of collaborators. These include academic institutions, national research and extension systems, the private sector, and civil society groups with a stake in the rice sector. ■



Number of GRiSP partners in Asia by research theme.

Mr. Paguirigan is a GIS and database management specialist in Social Sciences Division (SSD). Dr. Laborte is a scientist and GIS specialist in SSD. Dr. Bouman is GRiSP director.

Who will suffer most from climate change? (Hint: Not you)

by Bill Gates

A few years ago, Melinda and I visited with a group of rice farmers in Bihar, India, one of the most flood-prone regions of the country. All of them were extremely poor and depended on the rice they grew to feed and support their families. When the monsoon rains arrived each year, the rivers would swell, threatening to flood their farms and ruin their crops. Still, they were willing to bet everything on the chance that their farm would be spared. It was a gamble they often lost. Their crops ruined, they would flee to the cities in search of odd jobs to feed their families. By the next year, however, they would return—often poorer than when they left—ready to plant again.

Our visit was a powerful reminder that for the world's poorest farmers, life is a high-wire act—without safety nets. They don't have access to improved seeds, fertilizer, irrigation systems, and other beneficial technologies, as farmers in rich countries do. And no crop insurance either to protect themselves against losses. Just one stroke of bad fortune—a drought, a flood, or an illness—is enough for them to tumble deeper into poverty and hunger.

Now, climate change is set to add a fresh layer of risk to their lives. Rising temperatures in the decades ahead will lead to major disruptions in agriculture, particularly in tropical zones. Crops won't grow because of too little rain or too much rain. Pests will thrive in the warmer climate and destroy crops.

Farmers in wealthier countries will experience changes too. But they have ways to manage these risks. They can plant drought-tolerant crops, use sophisticated soil analysis to make their land more productive, and protect themselves from losses with crop insurance.

The world's poorest farmers show up for work each day for the most part empty-handed. That's why of all the people who will suffer from climate change, they are likely to suffer the most.

Poor farmers will feel the sting of these changes at the same time the world needs their help to feed a growing population. By 2050, global food demand is expected to increase by 60%. Declining harvests would strain the global food system, increasing hunger and eroding the tremendous progress the world has made against poverty over the last half century.

I'm optimistic that we can avoid the worst impacts of climate change and feed the world—if we act now. Although the severest impacts of climate change may be several decades away, we have precious little time to find solutions for the world's most vulnerable farmers. There's an urgent need for governments to invest in new clean-energy innovations that will dramatically reduce greenhouse emissions and halt rising temperatures.

> "I'm optimistic that we can avoid the worst impacts of climate change and feed the world—if we act now."

At the same time, we need to recognize that it's already too late to stop all of the impacts of hotter temperatures. Even if the world discovered a cheap, clean energy source next week, it would take time for the world to kick its fossil fuel-powered habits and shift to a carbon-free future. Some impacts from climate change are inevitable. That's why it's critical for the world to invest in efforts to help the poorest adapt.

Here's the good news. Many of the tools they'll need to adapt are quite basic—things that they need anyway to grow more food and earn more income: access to financing, better seeds, fertilizer, training and markets where they can sell what they grow.

Other tools are new and tailored to the demands of a changing climate. The Gates Foundation and its partners have worked together to develop new varieties of seeds that grow even during times of drought or flooding. The rice farmers I met in Bihar, for instance, are now growing a new variety of flood-tolerant rice—nicknamed "scuba" rice[1]—that can survive two weeks underwater. If shifts in the weather pattern bring more flooding to their region, they are already prepared for it. Other rice varieties are being developed that can withstand drought, heat, cold, and soil problems like high salt contamination.

DURING HIS VISIT to IRRI headquarters in April 2015, Bill Gates (*right*) discusses flood-tolerant (Scuba) rice with Robert Zeigler, IRRI director general, and Abdelbagi Ismail, project leader of STRASA. (Photo by Isagani Serrano)

"The rice farmers I met in Bihar are now growing a new variety of flood-tolerant rice—nicknamed scuba rice."

All of these efforts have the power to transform lives. It's quite common to see these farmers double or triple their harvests and their incomes when they have access to the advances farmers in the rich world take for granted. This new prosperity allows them to improve their diets, invest in their farms, and send their children to school. It also pulls their lives back from the razor's edge, giving them a sense of security even if they have a bad harvest.

Of course, there will also be threats from climate change that we can't foresee. To be prepared, the world needs to accelerate research into seeds and supports for smallholder farmers. One of the most exciting innovations to help farmers is satellite technology. In Africa, researchers are using satellite images to create detailed soil maps, which can inform farmers about what varieties will thrive on their land.

Still, it's not enough to develop a better seed or a new technology. None of these innovations can transform the lives of farming families until they're in their hands. A number of organizations, including a nonprofit group called One Acre Fund, are finding ways to ensure farmers take advantage of these solutions. One Acre Fund takes an impressive hands-on approach working closely with African communities to provide financing, tools, and training that will help them increase their productivity. They currently work with more than 200,000 farmers and are looking to scale up to reach one million farmers by 2020.

In this year's Annual Letter, Melinda and I made a bet that Africa will be able to feed itself in the next 15 years. Even with the risks of climate change, that's a bet I stand by.

Yes, poor farmers have it tough. Their lives are puzzles with so many pieces to get right—from planting the right seeds and using the correct fertilizer to getting training and having a place to sell their harvest. If just one piece falls out of place, their lives can fall apart.

I know the world has what it takes to help put those pieces in place for both the challenges they face today and the ones they'll face tomorrow. Most importantly, I know the farmers do too. ■

Bill Gates is the cofounder of Microsoft and the Bill & Melinda Gates Foundation. This commentary first appeared at Project Syndicate *(the world's opinion page) and later in the September installment of* gatesnotes, *the blog of Bill Gates, reprinted here with permission.*

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[1] Scuba rice, developed by IRRI and its partners, is being promoted by the Stress-Tolerant Rice for Africa and South Asia (STRASA) Project, an IRRI-led project supported by the Bill & Melinda Gates Foundation.

Creating the Future
SATAKE

The changing market in Myanmar

Traditionally rice was a crop consumed locally in the country of production. However, in the last 20 years this trend has been changing rapidly. Exports of rice have doubled, reaching over 40 million tons in 2012. Among the already well-known exporters of rice (such as Thailand, India, and Vietnam) Myanmar has also shown a tremendous growth with exports of 800,000 tons in the year 2010 rising to 1,200,000 tons by the year 2014.

Under such a trend, the rice mills in Myanmar are rapidly transforming themselves to highly efficient, more modern production facilities. One such state of the art rice mill adopting the latest technologies from Satake has been completed in Naypyidaw, the capital of Myanmar. This was the first private rice mill to adopt the modern rice milling system in the region but many are set to follow. The rice mill includes complete processing lines from pre-cleaning, paddy husking, milling, fine grading, sorting and packing. Color sorters employed are of the latest model manufactured in Japan. The laboratory room is also equipped with a full set of laboratory equipment to control the product quality.

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