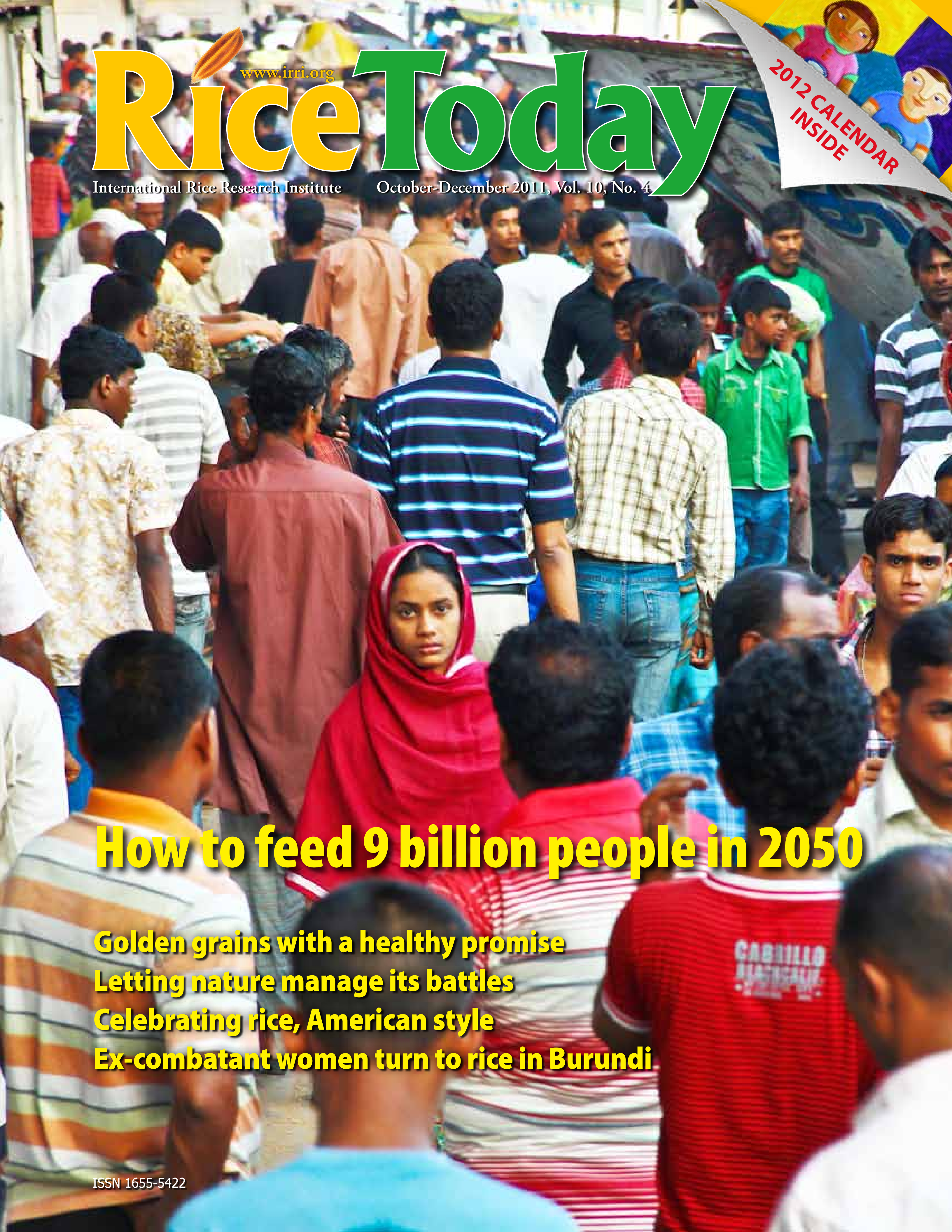

Rice Today

www.irri.org

International Rice Research Institute
October-December 2011, Vol. 10, No. 4

2012 CALENDAR INSIDE

How to feed 9 billion people in 2050

Golden grains with a healthy promise
Letting nature manage its battles
Celebrating rice, American style
Ex-combatant women turn to rice in Burundi

ISSN 1655-5422

contents

On the cover:
Dhaka, the capital of Bangladesh, has the highest population growth in the world. And, like many countries in Asia and Africa, Bangladesh is home to many millions of poor and hungry people who depend on rice as their staple food. As the world population heads toward 9 billion in 2050, the challenge of food security will increase.

Rice Today is published by The Rice Trader Inc. (TRT) in association with the International Rice Research Institute (IRRI).

TRT, for 21 years, has brought subscribers crucial, up-to-the-minute information on rice trade through its weekly publication, *The Rice Trader*. Acknowledged as the only source of confidential information about the rice market, this weekly summary of market data analysis has helped both the leading commercial rice companies and regional government officials make informed decisions, which are critical in today's market.

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 supported, in part, by members of the Consultative Group on International Agricultural Research (CGIAR – www.cgiar.org) and a range of other funding agencies.

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The opinions expressed by columnists in *Rice Today* do not necessarily reflect the views of TRT or IRRI.

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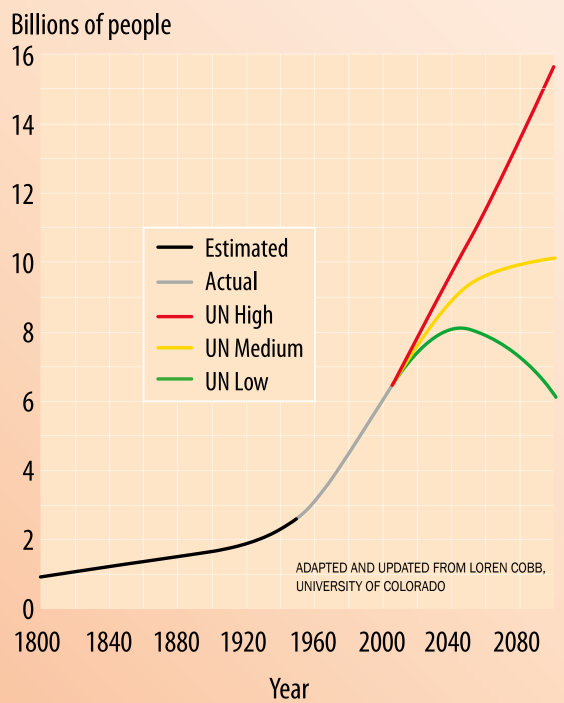
Monitoring an inconvenient divergence

For several years now, I have been monitoring, with some alarm, the world population clock on the front page of IRRI's Web site. This clock is forever ticking upward, while, at the same time, the global productive land clock just beneath it is forever ticking downward. Truly, this is an inconvenient divergence of more and more people depending on less and less arable land, pasture land, and forest from which they must obtain food and other vital resources. The respective clocks are diverging at a current rate of around 2.4 persons per second and 1 hectare every 7.67 seconds!

In a few weeks (31 October to be exact), our population clock, which we have synchronized to match the medium variant in the United Nations' recent 2010 Revision of the World Population Prospects, will reach the 7 billion milestone. It does not escape me that almost half of this mass of humanity continues to depend on rice for its staple food.



What of the future? If we follow the UN's medium predictions, our clock will show around 9 billion by mid-century (yellow line on the graph)—now less than 40 years away—and level off at around 10.1 billion by 2100. However, if global fertility were just 0.5 child more per woman than expected, our clock in 2050 and 2100 could show as many as 10.6 billion and 15.8 billion (red line on graph), respectively—very scary and hardly imaginable! Going the other direction with global fertility being just 0.5 child less per woman than expected, the clock would show 8.1 billion in 2050 and then reverse course to only 6.2 billion at the end of the century (green line on graph). The medium prediction is probably more likely, at least for 2050, since people who will be 40 years old and older by then have already been born.

Although we should take all three scenarios in the graph "with a grain of salt," I think it is probably most prudent to take the middle road. If world population does stabilize at around 10 billion by the turn of the century, at which it hopefully will have reached a replacement-only level, we should be able to meet the still formidable challenge of feeding that many people with focused and cutting-edge agricultural research. We have the tools available—particularly in rice research now driven by the Global Rice Science Partnership (GRiSP)—to increase productivity significantly in the coming decades.

Shining examples of our impressive research progress to help us tackle problems associated with more people and less land are showcased in IRRI's 2010 Annual Report. In addition, advances we are making in both favorable and unfavorable rice environments are featured in this issue of *Rice Today*, where we take close looks at the Impact of the Irrigated Rice Research Consortium (IRRC) and Consortium for Unfavorable Rice Environments (CURE), partners in the highlands.

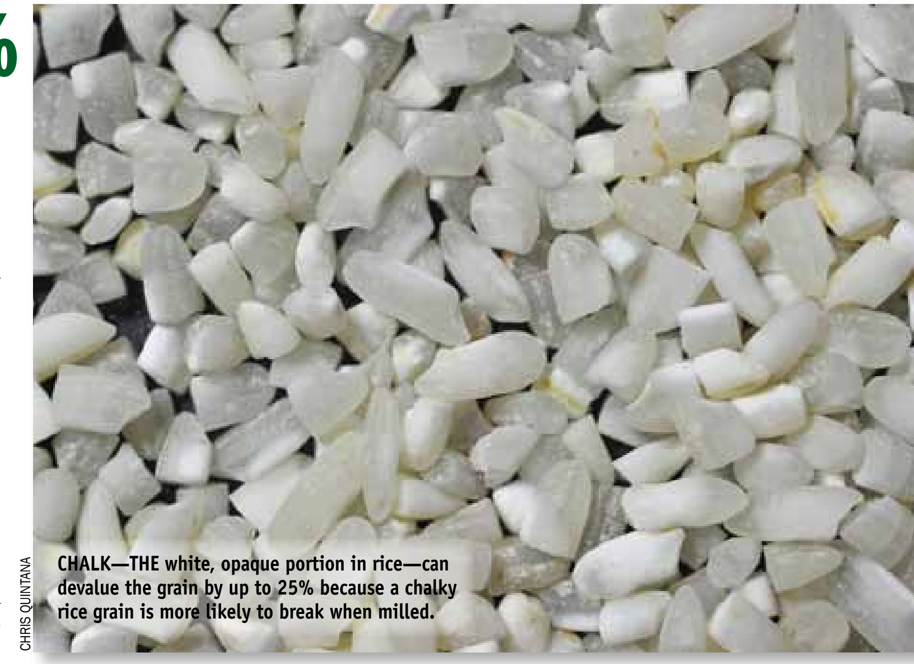
To underscore the population dilemma for this issue, we feature two CGIAR (Consultative Group on International Agricultural Research) directors general as special columnists—Papa Seck, who leads the Africa Rice Center, one of our major GRiSP partners; and Shenggen Fan, at the helm of the International Food Policy Research Institute in Washington, D.C. Assuming the 9 billion or so scenario for 2050, Dr. Seck believes that sub-Saharan Africa will play a significant role in global food security in the coming decades. This is because, unlike Asia and Europe, where the availability of potential land and water for agriculture is declining, Africa still possesses a large reservoir of underused agricultural land and water resources. In the *Grain of Truth* section, Dr. Fan warns that population growth and land constraints are not the only forces of change that are challenging food security, especially where rice is concerned. We also have to add to the mix increased input and labor costs, water constraints, and climate change.

Adhering to the UN's medium prediction, the Global Harvest Initiative calculates that, if we are to feed the 9+ billion people sharing our planet by 2050, we will need to produce as much food in the next 40 years as we have in the last 8,000! As daunting as that concept is, I believe we can improve productivity enough to achieve it. Ironically, it will be due to what I call the "convenient convergence" of solving simultaneously today's problems of floods, drought, seawater incursion, etc., and tomorrow's problems tied to inevitable climate change and the continuing "inconvenient divergence" of more people and less land.

Robert S. Zeigler
Director General

News

"Chalky" discovery could increase value of rice by 25%



CHRIS QUINTANA

CHALK—THE white, opaque portion in rice—can devalue the grain by up to 25% because a chalky rice grain is more likely to break when milled.

In a major discovery, the International Rice Research Institute (IRRI) uncovered important genetic information on what makes rice chalky—an undesirable trait that can devalue the grain by up to 25%.

This discovery could lead to higher quality "chalk-free" rice. Chalk-free rice has higher milling recovery, which means better returns for farmers.

Chalk, the white, opaque portion in rice, increases the chances of the rice grain breaking when milled. This reduces the amount of rice recovered, and downgrades the quality assessment rating of rice.

"Two things cause chalkiness in a rice grain: genetics and environment," explains Dr. Melissa Fitzgerald, leader of IRRI's grain quality and nutrition research.

Farmers cannot answer for the genetics of rice; neither can they do anything about the environment. But, one thing is clear—farmers want to keep their grains translucent and appealing to consumers to gain more from their field.

"Before, rice scientists did not know where in the rice genome the genes for chalkiness resided," asserts Dr. Fitzgerald. For more than 15 years, Dr. Fitzgerald has been trying to understand what makes rice chalky because understanding this will pave the way to creating chalk-free rice varieties.

"Currently, only a few commercially available rice varieties have genuinely low chalkiness," says Dr. Fitzgerald. "Our discovery can help us improve on this."

Dr. Fitzgerald's team, which includes Dr. Xiangqian Zhao, a postdoctoral research fellow, Dr. Adoracion Resurreccion, Ms. Venea Dara Daygon, and Mr. Ferdinand Salisi, worked with many lines of rice with different chalkiness properties.

In 2010, crucial data from field tests in eight different countries each with different growing environments came in. These field test results showed three groups of rice: rice that was always very high in chalkiness, rice that varied in chalkiness depending on the environment, and rice with extremely low chalk.

After analyzing the third group of rice, the extremely low chalky ones, scientists were able to identify major regions in the rice genome, or candidate genes, that are responsible for chalkiness. The discovery of these regions puts IRRI scientists a step closer to identifying the actual genes that give rice its chalky trait.

"We are now working with the extremely low-chalk rice to generate different breeding lines to develop new chalk-free rice varieties," declares Dr. Zhao. "These can help farmers increase the amount of edible rice they harvest, produce higher quality rice, increase profit, and deliver higher quality rice to consumers."

This research is supported by the Australian Centre for International Agricultural Research. ■

ISAGANI SERRANO

DR. MELISSA Fitzgerald (*far right*) and her team aim to develop chalk-free rice varieties.

Rice mechanization "roadmap" for Africa

Rice stakeholders from sub-Saharan Africa (SSA) recently met and recommended a series of actions to improve mechanization to increase the productivity and competitiveness of rice production in the region.

The stakeholders emphasized that small equipment, such as 2-wheel tractors, row seeders, mechanical threshers, small combine harvesters, and small mills, needs to be tested and, where possible, manufactured locally.

National governments were urged to consult research organizations when importing machinery to ensure that, in addition to being effective and durable, the technology is well adapted to local rice-growing conditions and can be serviced and repaired locally.

"According to conservative estimates based on recent surveys in 18 countries in SSA, cutting by half the on-farm postharvest losses through the use of improved technologies would lead to a savings of 0.9 million tons of milled rice," said Dr. Marco Wopereis, deputy director general for research, Africa Rice Center.

"The amount of rice saved is equivalent to nearly 17% of rice imports into the region and has a real value of US$410 million in 2011," he added. "This can help lift about 2.8 million persons in rice-farming households out of poverty."

THE ASI rice thresher has been adapted and introduced by AfricaRice in collaboration with IRRI, national extension services, and local manufacturers in several countries in West and Central Africa.

R. RAMAN

Promising technologies for highly labor-intensive activities, such as land preparation, seeding, weeding, harvesting, and processing of rice, and sustainable approaches for their introduction, testing, and outscaling were presented at the meeting.

The ASI thresher-cleaner was cited as a successful example. The ASI has received high recognition in the region, including the Senegal Presidential Award and praise from the Chad government.

The participants agreed that the key factors for a sustainable mechanization program are appropriate technologies, sound business principles, local ownership, dealer support, government backing, and local training in the use and maintenance of equipment. ■

Source: www.africarice.org

New media boost California rice

The California Rice Commission (CRC) has ramped up industry communication through social media such as Facebook, YouTube, Twitter, and blogs.

"This is a new area for us, and the interest generated through social media is encouraging," said rice grower and CRC Chairman Charley Mathews, a farmer in the Sacramento Valley. "Keeping legislators and others in urban areas informed about the importance of California rice is essential in telling our story." ■

Sri Lanka gets rice help

The Bathalagoda Rice Research and Development Institute (RRDI) in Sri Lanka has reported on its progress in helping rice farmers deal with climate change and unpredictable weather.

According to RRDI Director Nimal Dissanayake, the RRDI has developed rice varieties and technologies to cultivate rice with less water without affecting the yield. This includes a short-duration rice that can yield 5 tons per hectare. ■

Source: www.dailynews.lk

Rice bran as protein source

DSM Innovation Center and NutraCea have announced an agreement to investigate extracting and modifying high-quality vegetable proteins from rice bran.

NutraCea's Chief Executive Officer W. John Short said that rice bran is hypoallergenic and gluten free, has a full range of amino acids, and is easily digested, making it a potential additional protein source to feed a growing world. ■

Source: www.foodproductdesign.com

Pump cuts carbon emissions

A rice hull gasifier engine-pump developed by the Philippine Rice Research Institute (PhilRice) not only cuts costs in running irrigation pumps but also reduces the carbon footprint in rice fields.

Rice hulls—the outer layers of a grain of rice that are removed before the rice can be eaten—are a by-product of processing rice. The equipment allows rice hulls to be "burned" through an efficient mechanism that generates power to run pumps to irrigate rice fields.

PhilRice said the local mobile gasifier engine-pump system slashes irrigation costs by a maximum of 37% when using gasoline and by 44% if it is run by diesel.

Field tests also showed the gasifier can endure 100 hours of cumulative use with minimal problems. The machine, now made compact, mobile, and affordable, also reduces greenhouse gas emissions as rice hulls are converted to power the machine.

Moreover, wastes produced after rice hull burning within the system can be used as a soil conditioner in seedbeds, mulching material, and an ingredient in producing organic fertilizer.

Arnold S. Juliano, a member of the team from PhilRice who developed the machine, said, "By continuously improving the machine, we hope that more farmer cooperatives will invest, not only to save, but to help reduce the contribution of burning rice hulls to global warming."

In using the machine, Engr. Juliano advised that the rice hull load should be clean and dry to produce quality gas that can run the engine with high speed and maintain good water-pumping performance. ■

Source: www.mb.com.ph

PHILRICE

In addition to *Rice Today*, others are also recognizing the looming 7 billion milestone. For example, *National Geographic*, throughout 2011, has been devoting a 7-part series examining specific challenges and solutions. And, the United Nations Population Fund will start a 7-day count-up beginning on 24 October, which will include a series of events culminating with the launch of the State of World Population 2011 report, which will analyze the challenges and opportunities presented by a world of 7 billion.

Caritas joins rice research

Caritas in Bangladesh has joined the Bangladesh Rice Research Institute (BRRI) in a 6-year deal for research and production of rice.

"We've considered Caritas to be our worthy partner in rice research and training," said BRRI Research Director Khairul Bashar.

The deal, financed by the European Union, includes research, disseminating rice-related information, and training poor farmers nationwide.

"Our partnership will benefit farmers countrywide and help the country become self-sufficient in food," said Alo D'Rozario, Caritas executive director. ■

Source: www.cathnewsindia.com

Singapore banks on rice security

Singapore's National Research Foundation will invest up to US$8.2 million over 5 years in a new rice research program to help ensure that rice is enough to meet the future demand of Singapore and the region.

The grant will support research between the National University of Singapore (NUS) and Temasek Life Sciences Laboratory (TLL) in collaboration with the International Rice Research Institute (IRRI).

The project will be led by Professor Prakash Kumar from the NUS Department of Biological Sciences and Dr. Naweed Naqvi from TLL, Singapore.

"This grant from the National Research Foundation will enable our teams to help improve yield and disease resistance in rice, and to adapt the crop to rapidly changing environmental conditions," said Prof. Kumar.

Dr. Naqvi added, "Our collaboration with IRRI will help position Singapore as a strategic partner in regional and global food security. We will now be able to link the excellent research done here in Singapore to many other rice improvement activities worldwide." ■

TRAINING COURSES AT IRRI

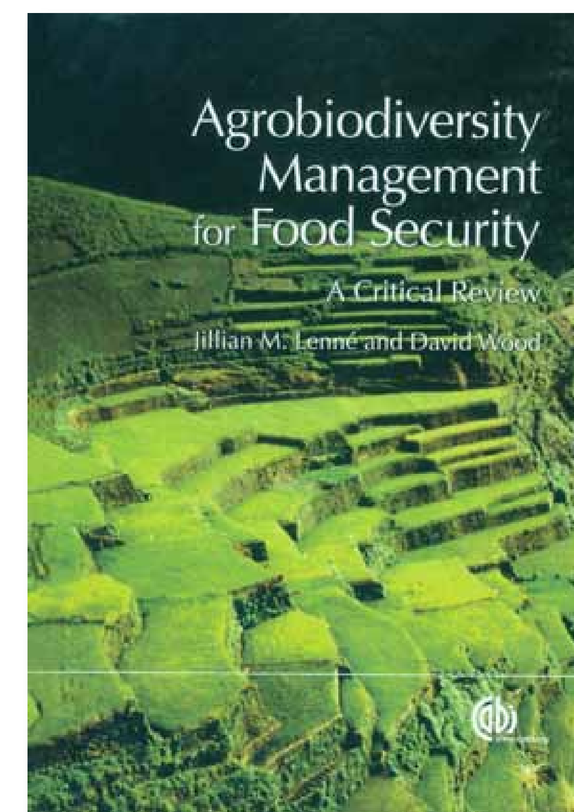
Course title	Date	Venue	Target participants	Course fee (US$)
Media Skills	7-8 November	Colombo, Sri Lanka	CGIAR senior staff (by nomination)	1,250
Leadership Course for Asian and African Women for Research and Extension in Rainfed Rice Ecosystems (in ESA)	7-18 November	Bangladesh	Women researchers, research managers, and professionals in agricultural RD&E	2,400
Project Management	14-18 November	IRRI, Dar es Salaam, Tanzania	CGIAR early-career scientists/postdocs	2,200
Writing a Research Article for International Publication	28 November -2 December	IRRI, Philippines	Graduate students or early-career researchers	1,820
Guiding Novice Authors to Write Scientific Articles for International Publications	5-7 December	IRRI, Philippines	Senior researchers, scientists, and postdocs or others with an appropriate publication record	1,700
Intercultural Thesis Supervision: Strategies for IRRI (and other centers)	8-9 December	IRRI, Philippines	Senior scientists/researchers or others with thesis supervisory responsibilities	1,330

For inquiries, contact IRRITraining@cgiar.org; m.maghuyop@cgiar.org, m.sagabay@cgiar.org, v.bartolome@cgiar.org, or d.arreza@cgiar.org. Phone: (63-2) 580-5600, ext. 2538, 2623, 2437, or 2393; fax: (63-2) 580-5699, 891-1292, 845-0606; mailing address: The IRRI Training Center, DAPO Box 7777, Metro Manila, Philippines (Attention: TC Course Coordinator); Web site: www.training.irri.org.

Books

Agrobiodiversity Management for Food Security: A Critical Review

Edited by Jillian M. Lenné and David Wood; published by CABI



Agricultural biodiversity, or "agrobiodiversity," provides most of our food through our interaction with crops and domestic animals. It also includes wild relatives of domestic species, pollinators, symbionts, parasites, and pests.

Since future global food security is firmly anchored in sound, science-based management of agrobiodiversity, this book presents key concepts of agrobiodiversity management. It critically reviews important current and emerging topics, including agricultural development, crop introduction, practical diversity in farming systems, the impact of modern crop varieties and genetically modified (GM) crops, conservation, climate change, and policies. It also tackles claims and misinformation on the subject.

Further enhanced by contributions from international experts in selected key areas, this book is an essential resource for policymakers, researchers, and students in ecology, agricultural science, and agricultural management. To order online at the CABI Bookshop, go to http://snipurl.com/agrobiodiversity. To preview chapters, go to Google Books at http://snipurl.com/agrobiodiversity2.

Rice Today around the world

FRIENDS, FRIENDS ON THE WALL. After a long walk on the Great Wall of China, a group of friends—with IRRI as their common ground—rest to pose with *Rice Today*. At the back from *left to right* are Salvie Mariñas, Ole Sander, Maya Capiña, Eduardo Crisol Martínez, Ainara Peñalver Cruz, and Artzai Solano, and in front are Thais Freitas and Denis Díaz.

CUTESY READING DOG. Clifford, together with IRRI's on-the-job trainees (*from left*) Clara Cambaliza and Tintin Calda and IRRI staff Sherri Meneses, poses with *Rice Today* in hand, nay, in paws, at IRRI's Scholastic Book Fair, which aims to inculcate a love for reading in children.

TROPICAL FLAVORS OF THE MIND. IRRI's liaison scientist for Indonesia Dr. Zulkifli Zaini (*middle*) holds *Rice Today* at the Indonesian Rice Research Center in Sukamandi, Indonesia. Also in the picture are IRRI's Dr. Roland Buresh (*left*) and Dr. Hasil Sembiring (*right*), director for the Indonesian Center for Food Crops Research and Development.

SINGING TO THEIR HEART'S CONTENT. The University of the Philippines Rural High School Glee Club bagged three medals in the 4th Grand Prix Pattaya International Choir Festival held in Thailand. The Glee Club has performed at many IRRI functions before, and in this photo the members hold *Rice Today* with triumphant smiles.

ISAGANI SERRANO

Feeding the world in 2050

by **Papa Abdoulaye Seck**

Sub-Saharan Africa will play a vital role in food security in the coming decades as population increases

The world population is expected to increase *almost* as sure as the sun rises in the east. Much of this increase will be concentrated in developing countries, with sub-Saharan Africa (SSA) leading the way, as its population is estimated to double from 770 million in 2005 to 1.5 billion by 2050.

According to the United Nations Food and Agriculture Organization (FAO), global food production must increase by 70% to feed the world—a challenge that has never been as demanding as now, in the face of climate change and soaring food prices, which inflict serious damage on the food security of the poorest households.

Moreover, the rate of yield growth of major cereal crops dropped from 3.2% per year in 1960 to 1.5% in 2000. While environmental degradation heightens in several parts of the world, the potential for an increased use of agriculturally critical natural resources such as land and water is declining. Climate change is aggravating the severity and uncertainty of weather events.

However, lessons learned from the past indicate that advances in science and technology can expand the world's agricultural frontier and sufficient food can be produced to nourish the growing population in the future.

We believe that SSA will play a significant role in global food security in the coming decades. Unlike Asia and Europe, where the availability of potential land and water for agriculture is declining, Africa still has a large reservoir of underused agricultural land and water resources.

Only 150 million hectares out of the total cultivable area of 875 million hectares are currently harvested. The continent is using about 4% of its water resources and has annual renewable water resources of about 5.4 trillion cubic meters.

Moreover, several staple food crops are produced at competitive costs in SSA. The recent upward trends in agricultural commodity prices reinforce the competitiveness of agricultural production in SSA.

Investing in agriculture

To feed around 9 billion people in 2050 (see *Monitoring an inconvenient divergence* on page 4), agriculture in developing countries needs a net investment of about US$83 billion per year, says FAO. In the last two decades, agriculture was neglected by both developing countries and donors. The Organisation for Economic Co-operation and Development estimates that official development assistance to agriculture fell by 43% between the mid-1980s and 2008.

In SSA, agriculture remains a powerful engine for economic growth, food security, and poverty reduction, accounting for 35% of GDP, 75% of employment, and 40% of exports. Estimates say that a dollar of farm income increases the overall economy (e.g., $1.88 in Burkina Faso and $1.48 in Zambia). Despite this, SSA governments have failed to prioritize the sector and to reverse decades of policy bias against agricultural production.

In 2003, African countries adopted the Comprehensive Africa Agriculture Development Programme in Maputo, Mozambique, and pledged to increase agricultural spending by at least 10% of the total government budget by 2008. But, only eight countries have reached the 10% budget quota for agriculture, and the continent's average is only 4–6%.

Without consistent investment in its own domestic agricultural resources, SSA cannot fully seize the opportunity for transforming this strategic sector.

Supporting agricultural R&D

To feed the world in 2050, investments in agricultural research and extension must be substantially increased, particularly in SSA, where agricultural productivity generally lags behind the rest of the world. A case in point: annual paddy yield in Asia almost doubled from 2.06 tons per hectare in the 1960s to 4.06 tons per hectare in the 2000s, while in SSA it just increased from 1.81 tons per hectare to 2.31 tons per hectare over the same period.

Given the context specificity of agriculture, technology transfer has limited effectiveness. In the 1960s, a stock of proven agricultural technologies in Asian countries was assumed to be effective and adaptable to African conditions.



INCREASED AGRICULTURAL production is key to enhancing food security in sub-Saharan Africa, where the population is expected to increase from 770 million in 2005 to 1.5 billion by 2050.

R. RAMAN (3)

But, many imported varieties failed to outperform local species. In fact, out of more than 2,000 Asian varieties of mangrove rice for testing in the African environment, only two performed comparably to the best local varieties. Generally, varieties imported from other regions into SSA were not adapted to local conditions.

The failure of direct technology transfer underscores the need for developing endogenous research capacities in SSA. Although the internal rate of return on agricultural research is above 20%, agricultural R&D has suffered from decades of inadequate investments, particularly in the 1980s and 1990s. A recent report, however, indicates a 20% increase in spending between 2001 and 2008 on agricultural R&D.

Agricultural extension and advisory service represent another key area of investment to stimulate agricultural productivity in SSA through widespread dissemination of new information and knowledge.

Closing the yield gap

AfricaRice has shown that integrated crop management (ICM), a step-wise approach of integrating new technological options into production systems with full farmer participation, is a promising way for SSA, in view of the large gaps between actual farmers' yields and attainable yields under better management. In Mali, ICM technological options increased its average rice yield in irrigated areas from 2 to 6 tons per hectare.

With improved technology, average yields of cassava more than doubled from 8.6 tons per hectare to 20.8 tons per hectare under farmer management. And, the use of inorganic fertilizer can increase mean maize yields from 1.4 tons per hectare to 3.9 tons per hectare.

Closing the yield gap for the main staple food crops in SSA is critical to increase agricultural productivity while meeting the regional and global food security challenge.

AfricaRice's recent simulation illustrates this point well. By bridging the attainable yield gap in the three main rice ecologies (upland, rainfed lowland, and irrigated), while doubling the areas under irrigated and lowland rice production, SSA can meet its requirements in rice and even produce a surplus of 5 million tons for export.

Institutional and infrastructural development

However, even with proven agricultural technologies, dissemination and adoption by farmers are hampered by limited effective demand, restricted access to information and credit, as well as poor institutional and infrastructural development.

Despite the availability of improved seed technologies developed by agricultural research organizations in Africa, adoption by farmers remains limited. Greater public involvement is needed to overcome market failures that are affecting the national seed system.

In addition, core infrastructure such as electricity, storage, and rural roads is vital to transform SSA's agriculture. For instance, better road infrastructure would help reduce transportation costs and improve access to markets.

The average amount of fertilizer applied in SSA was only about 9 kilograms per hectare in 2002, against the global average of 101 kilograms. This gap clearly indicates that African agriculture has enormous productivity potential if only it had better access to fertilizers.

A combo of four

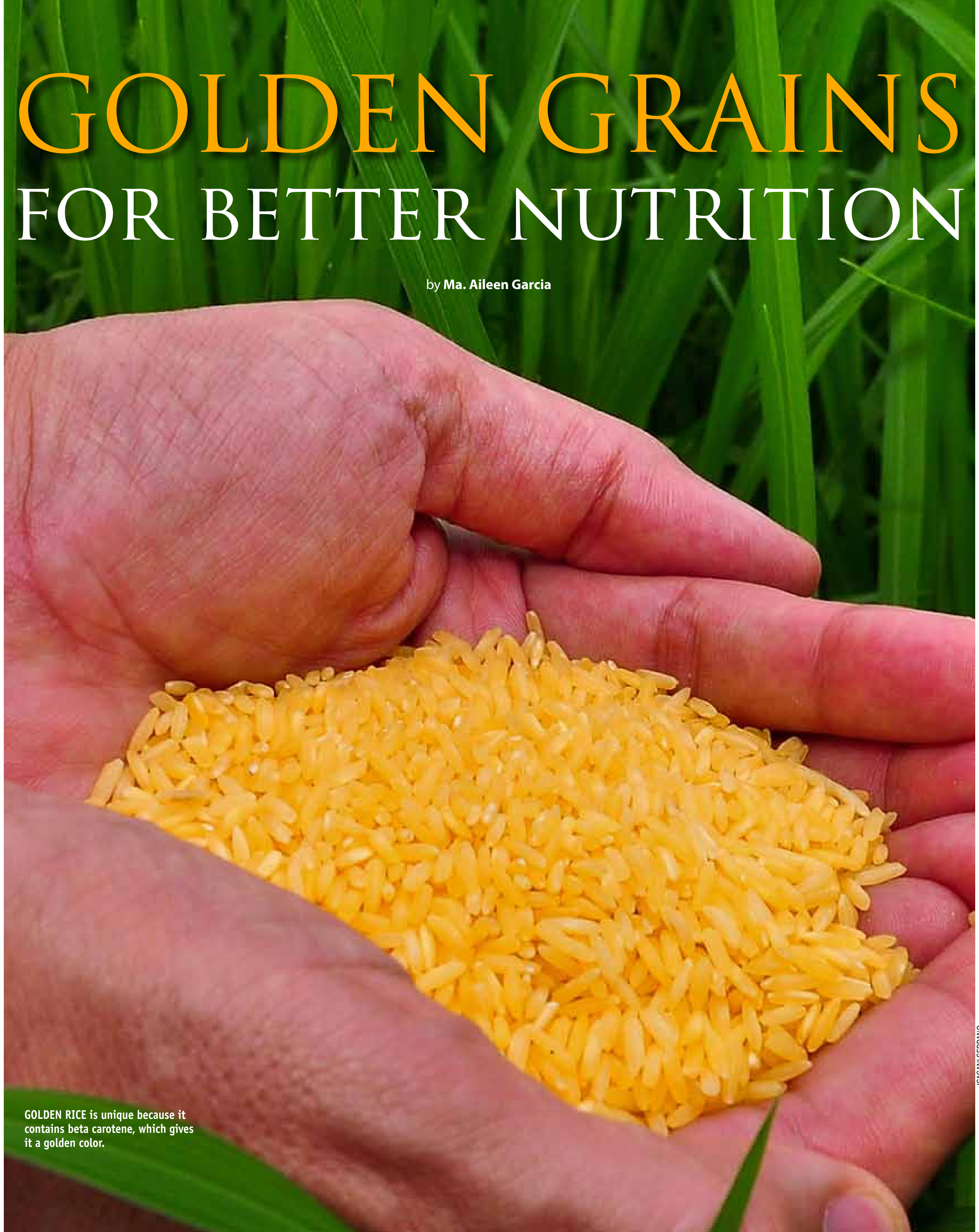
Yet, producing enough food at the aggregate level will not necessarily translate into adequate food security and equitable access to food by all. Improving agricultural productivity should be a constitutive part of a pro-poor growth strategy that sustains the generation of sufficient off-farm jobs.

To feed the world in 2050, an intelligent combination of four factors is essential: appropriate technologies, good infrastructure, favorable economic and institutional environment, and the preservation of natural resources. Only then can science be certain of making the greatest impact on resource-poor farmers and the burgeoning urban population in 2050.

Dr. Seck is the director general of the Africa Rice Center.

GOLDEN GRAINS FOR BETTER NUTRITION

by **Ma. Aileen Garcia**



ISAGANI SERRANO

GOLDEN RICE is unique because it contains beta carotene, which gives it a golden color.

Emma is a 38-year-old mother of eight from the Philippines. She earns a living as a cleaning lady, and putting food on the table is a challenge that she and her husband face each day.

For Emma and many other families in Asia, rice is the staple food, which eats up the family's meager budget. "We depend on rice every day, because it is filling," she said. "Most of the time, however, we cannot afford fish, meat, or vegetables. We only sprinkle salt or soy sauce to add some flavor or sometimes prepare rice as porridge.

"I know this lacks the important nutrients that will help make my children grow healthy, but what can I do? We have to fill our stomachs first," Emma laments.

Families around the world, like Emma's, consume only nutrient-poor staple foods because other nutritious food such as meat products, vegetables, and fruits are scarce, unavailable, or too expensive. This contributes to hidden hunger—malnutrition from micronutrients. With the ballooning world population, "hidden hunger" will also likely rise.

Lack of sufficient vitamin A in the diet reduces the body's ability to fight infections such as diarrhea and measles. It can also cause blindness and increases the risk of death. Vitamin A is particularly important for children as well as pregnant and lactating women as their nutrient needs are increased.

Asia has one of the highest prevalences of vitamin A deficiency in the world. It is considered a public health problem in many Asian countries with 33.5% of preschool children afflicted. In 2009, the World Health Organization reported that more than 90 million children in Southeast Asia suffered from it, more than in any other region. Each year, it is estimated that 670,000 children under the age of five die because they are vitamin A-deficient, and another 350,000 go blind.

The Philippines' Food and Nutrition Research Institute (FNRI) reported that, in 2003, vitamin A deficiency afflicted 40.1% of Filipino children, 15.5% of pregnant women, and 20.1% of lactating women, making it a serious public health concern.

To address the vitamin A deficiency problem in the Philippines, the government, together with nongovernment organizations and the private sector, has been implementing far-reaching programs such as the distribution of vitamin A capsules. *Sangkap Pinoy,* a food fortification program, was also established to ensure that food products such as noodles are fortified with vitamin A along with other micronutrients.

Owing in part to these programs, recent data indicate that the population's vitamin A status has improved. The National Nutrition Survey conducted by FNRI in 2008 showed a decreasing trend in vitamin A deficiency among children aged 6 to 59 months (15.2%), pregnant women (9.5%), and lactating women (6.4%).

Despite these positive developments, however, vitamin A deficiency remains a significant public health problem in many less developed countries according to Nancy Haselow, vice president and regional director of Helen Keller International (HKI). HKI has been advocating the elimination of vitamin A deficiency for more than 40 years, working with governments and other partners to reach those most in need through various interventions.

She said, "The most vulnerable children and women in hard-to-reach areas are often missed by existing interventions that can improve vitamin A status, including vitamin A supplementation, food fortification, dietary diversification, and promotion of optimal breastfeeding."

Also, interventions such as vitamin A supplementation are sustainable only as long as there is funding and political will to continue. What if support for these programs halts?

A free-market driven, food-based effort with wide coverage that reaches poor areas could be more sustainable toward controlling vitamin A deficiency in the future, thus preventing blindness and earlier death. What could help fill the basket of options to tackle vitamin A deficiency?

A golden advantage

Golden Rice may be part of the answer.

Golden Rice is unique because it contains beta carotene, which gives it a golden color. The body converts beta carotene to vitamin A as it is needed. According to research published in 2009, daily consumption of a very modest amount of Golden Rice—about a cup—could supply 50% of the Recommended Daily Allowance of vitamin A for an adult.[1]

Through genetic modification, Golden Rice contains genes from maize and from a common soil microorganism that produce beta carotene in the grains. It was first developed by Prof. Ingo Potrykus, then of the Institute for Plant Sciences, Swiss Federal Institute of Technology, and Prof. Peter Beyer of the University of Freiburg, Germany.

By 1999, Prof. Potrykus and Dr. Beyer had produced a prototype Golden Rice and published their landmark research in *Science*. Since 2000, scientific research and international collaboration on Golden Rice have been supported by funding and in-kind support from the private, public, and philanthropic sectors. In 2005, a major breakthrough led to the development of a new Golden Rice that now produces more beta carotene. This became the foundation of the current efforts.

The beauty of Golden Rice lies in its potential to reach many people—who may not have regular access to other sources of vitamin A—because rice is widely produced and consumed. Rice is eaten and grown in more than 100 countries, including the Philippines, and is the staple food for more than 3 billion people. Rice provides 50–80% of the total caloric intake of most Asians, who are most affected by vitamin A deficiency.

"Since a large proportion of vitamin A–deficient children and their mothers reside in rice-consuming populations, particularly in Asia, Golden Rice should substantially reduce the prevalence and severity of vitamin A deficiency, and prevent at least hundreds

[1] *The American Journal of Clinical Nutrition.*

JILL KUEHNERT

AILEEN GARCIA (2)

PARMINDER VIRK, IRRI senior scientist; Alamgir Hossain, BRRI principal plant breeder; and Antonio Alfonso, PhilRice plant breeder and Golden Rice project leader (*at left, from left to right*).

EMMA LOOKS forward to the day when she can serve more nutritious rice to her children (*top*).

of thousands of unnecessary deaths and cases of blindness every year," said Alfred Sommer, professor and dean emeritus, Johns Hopkins Bloomberg School of Public Health. Dr. Sommer, an internationally acclaimed public health scientist, has been at the forefront of vitamin A deficiency research, leading major studies that were fundamental to the current understanding of the effect of vitamin A supplementation on mortality, malnutrition, and blindness.

If proven effective in improving vitamin A status, Golden Rice could be used in combination with existing approaches, including education, supplementation, and fortification programs, to overcome vitamin A deficiency. Golden Rice could become part of the long-sought solution, which farmers themselves can harvest from their own fields, year after year.

The Golden Rice project

Major nutrition and agricultural research organizations are now working together to further develop and evaluate Golden Rice as a potential way to reduce vitamin A deficiency in the Philippines and Bangladesh, among other countries.

The International Rice Research Institute (IRRI) leads the Golden Rice project and is directly involved in several agriculture-related aspects of the project, including initial breeding work to insert the new Golden Rice trait into rice varieties that were selected by the Philippine Rice Research Institute (PhilRice) and the Bangladesh Rice Research Institute (BRRI). This involves laboratory work, greenhouse tests, and some preliminary field evaluation. Potential Golden Rice varieties are then transferred to national rice institutes for further development and assessment.

"Golden Rice is an incredible innovation that we are proud to be working on," said IRRI Director General Robert Zeigler. "It has a huge potential to help reduce the devastating consequences of vitamin A deficiency in rice-growing and rice-consuming countries."

In the Philippines, PhilRice is at the forefront of developing new Golden Rice varieties that are suited to specific rice-growing conditions in the country. One popular rice variety being developed by PhilRice to have a Golden Rice counterpart is PSB Rc82, more commonly known in the market as Peñaranda. PhilRice has just recently conducted a confined field test, to be followed by multilocation field trials for several seasons, in accordance with regulatory requirements.

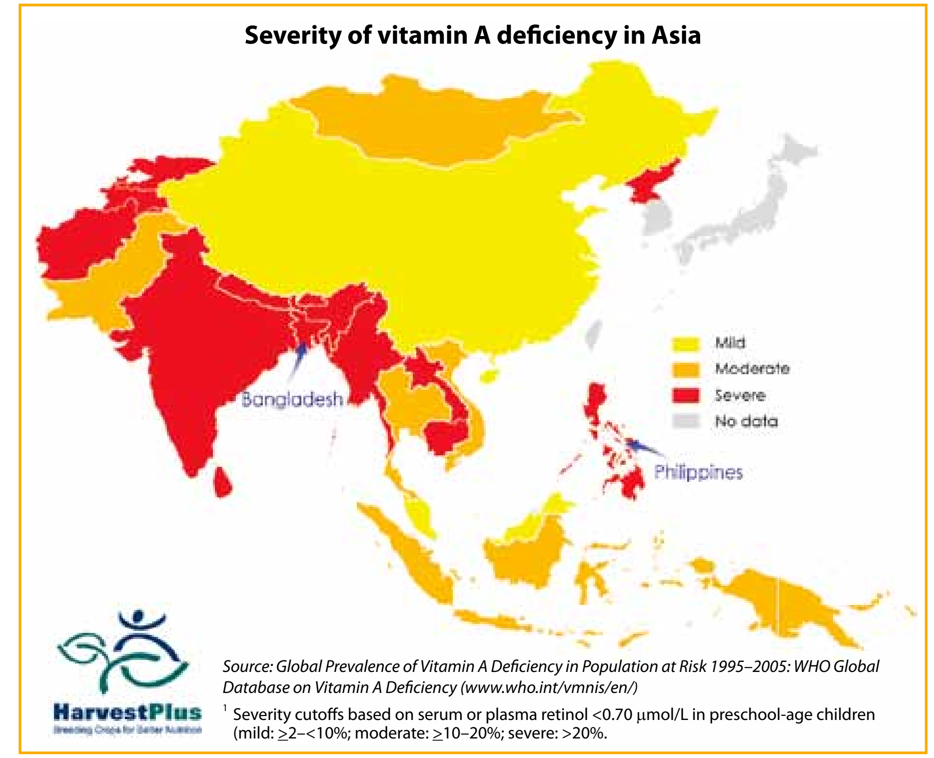
"We are conducting our breeding carefully to make sure that the new Golden Rice variety retains the same high yield, pest resistance, and excellent grain and eating qualities while helping to tackle the pervasive problem of vitamin A deficiency in the Philippines," said Dr. Antonio Alfonso, chief science specialist and Golden Rice team leader at PhilRice.

Safety first

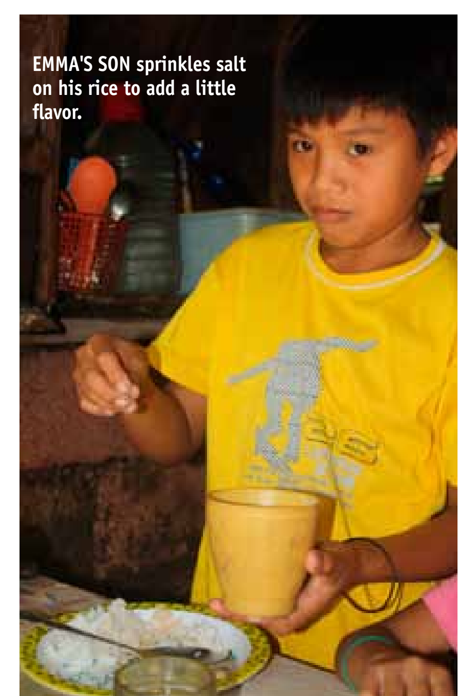
Like other genetically modified crops, Golden Rice will be made available to farmers and consumers only after it has been approved by national regulatory bodies.

To help establish the safety of Golden Rice in the environment, field trials and other evaluations will be conducted in both the Philippines and Bangladesh. Field trials are important, too, to show that Golden Rice grows the same as other rice in local conditions. Furthermore, these trials will inform the national regulators about the safety of Golden Rice, just like in the regulatory framework of Bangladesh.

Golden Rice will be assessed according to internationally accepted guidelines for the safe use of modern biotechnology, such as the *Codex Alimentarius* of the Food and Agriculture Organization and World Health Organization, OECD Consensus Guidelines, and the Cartagena Protocol on Biosafety. Philippine safety regulations contained in Department of Agriculture Administrative Order No. 8, Series of 2002, are based on these international guidelines.



PhilRice and BRRI will submit all safety information to their respective national government regulators, which may be as early as 2013 in the Philippines and later in Bangladesh. Regulators will review these data as part of the approval process for Golden Rice before it can be released to farmers and consumers.



EMMA'S SON sprinkles salt on his rice to add a little flavor.

Can Golden Rice make a difference?

Dr. Gerard Barry, Golden Rice network coordinator and IRRI's Golden Rice project leader, shared that his team has been working on Golden Rice since 2006 to develop a safe and effective way to deal with vitamin A deficiency, prevent blindness, and save lives.

"Our latest stage of work is now supported by the Bill & Melinda Gates Foundation," he said. "Helen Keller International, a leading nutrition organization, will also be involved to assess the efficacy of Golden Rice." If the safety of Golden Rice is confirmed, HKI, with university partners, will conduct some studies to see whether Golden Rice could help improve vitamin A status among deficient populations.

PhilRice and BRRI are breeding the Golden Rice trait into other rice varieties that are locally adapted and popular with farmers, matching their yields and other performance factors. Golden Rice seeds and grains will be available in the market and are expected to cost farmers and consumers the same as other rice. Cooking and taste tests will likewise help make sure these qualities of Golden Rice meet consumers' needs. The experience gained in developing, evaluating, and planning the delivery of Golden Rice in the Philippines and Bangladesh will be important in designing plans for Golden Rice in other countries, too.

Golden Rice offers a bright prospect for nutritionally enhanced crops to deliver on the promise of better nutrition. It could give Emma another nutritious food to rely on and a chance for her children and grandchildren to be healthier.

With Emma and those like her serving as an inspiration, the Golden Rice project partners continue to work to evaluate the safety and efficacy of Golden Rice in the Philippines as another potential approach to fighting vitamin A deficiency.

Golden Rice for Bangladesh

In Bangladesh, one in every five children aged 6 months to 5 years is estimated to be vitamin A-deficient. Among pregnant women, 23.7% had low serum retinol levels, indicating vitamin A deficiency.

As in the Philippines, rice is an indispensable part of the Bangladeshi diet, providing an average of more than 70% of calories every day. Unfortunately, most of the time, rice is all some Bangladeshis can afford to eat. Although rice fills their stomachs, it doesn't provide a source of healthy micronutrients such as vitamin A.

Dr. Alamgir Hossain, who is leading the Golden Rice work for BRRI, said that he has been working with the inventors of Golden Rice as well as with IRRI scientists for years. "Our work focuses on putting the Golden Rice trait into the best all-around varieties, such as BRRI dhan29, the most popular rice variety in Bangladesh.

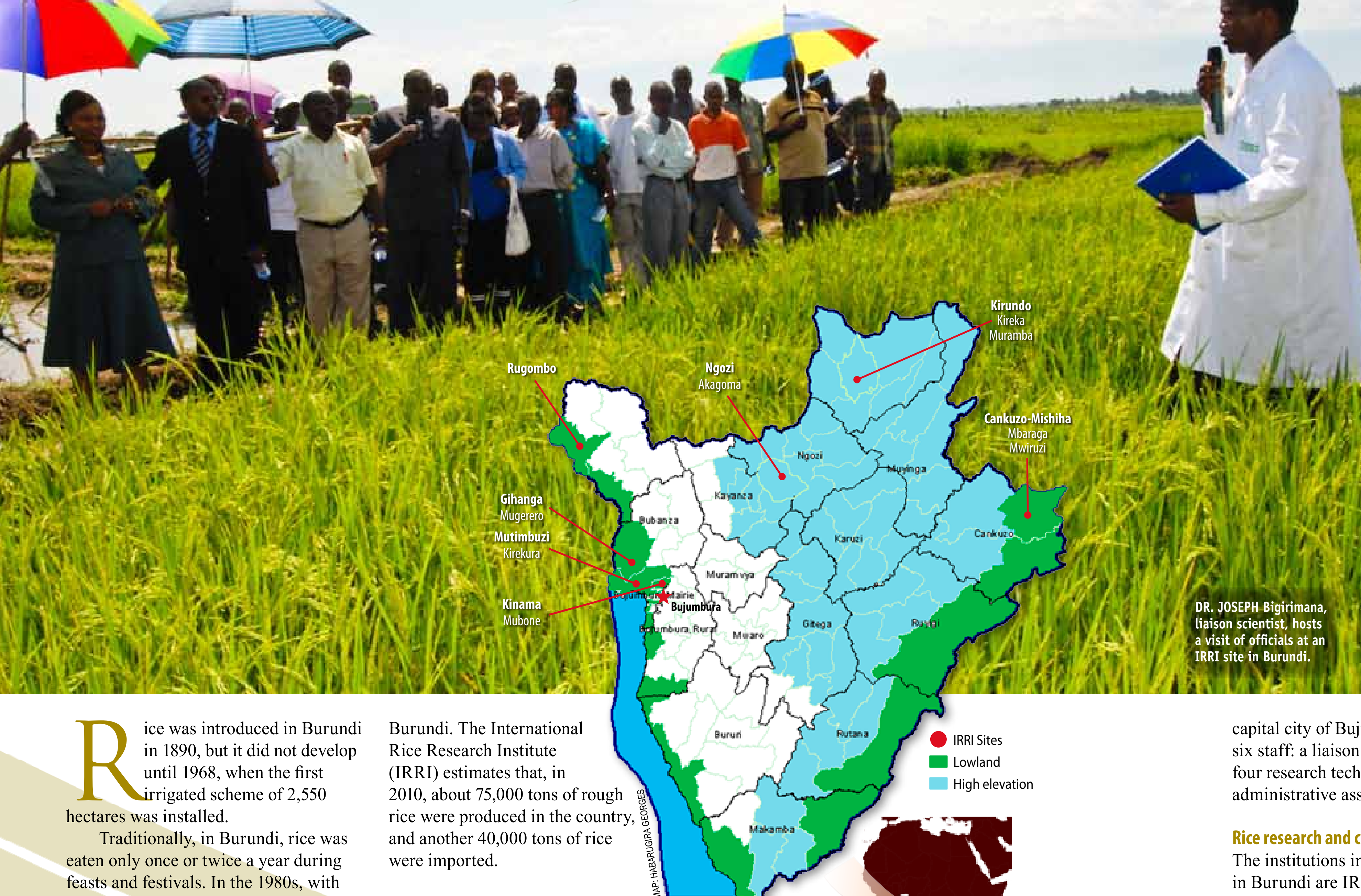
"As we do in all our work on rice, we will be looking at the performance of the Golden Rice version of BRRI dhan29 over many generations, across different regions of Bangladesh, and in different seasons.

"We want to be sure that Golden Rice grows just as well as the original, so farmers won't have to give up higher yield, or pest resistance, or other attributes in order to help those most in need of a potentially healthy and filling meal," he concluded.

COUNTRY SNAPSHOT:

IRRI in Burundi

Compiled by **Sophie Clayton**



MAP: HABARUGIRA GEORGES

DR. JOSEPH Bigirimana, liaison scientist, hosts a visit of officials at an IRRI site in Burundi.

Rice was introduced in Burundi in 1890, but it did not develop until 1968, when the first irrigated scheme of 2,550 hectares was installed.

Traditionally, in Burundi, rice was eaten only once or twice a year during feasts and festivals. In the 1980s, with the introduction of locally adapted rice and the distribution of rice in schools and the military by the government, it rapidly became popular. Now, many Burundians eat rice every day.

Burundi has three major rice-producing ecologies: the irrigated areas of the Imbo plain, the rainfed (nonirrigated) areas of Imbo and Moso lowlands, and the nonirrigated areas of the elevated marshland region.

Rice is grown once a year in Burundi. The International Rice Research Institute (IRRI) estimates that, in 2010, about 75,000 tons of rough rice were produced in the country, and another 40,000 tons of rice were imported.

IRRI in Burundi

IRRI started working in Burundi in 2008 when a Memorandum of Understanding between the country and the Institute was signed. The beginnings of this agreement came after current IRRI Liaison Scientist and Coordinator for Burundi Joseph Bigirimana attended the Rice Research to Production Training Course at IRRI in 2006.

IRRI now has an office within the University of Burundi campus, in the capital city of Bujumbura, and employs six staff: a liaison scientist/coordinator, four research technicians, and an administrative assistant.

Burundi: fast facts

Population (July 2011 estimate):	10.2 million[1]
Total land area (2011):	2.8 million ha[1]
Annual rice consumption (2007):	6.2 kg/person[2]
Area of rice production (2008):	21,000 ha[2]
Average rice yield (2008):	3.38 tons per ha[2]

[1] CIA World Factbook
[2] World Rice Statistics, www.irri.org/world-rice-statistics

Rice research and capacity building

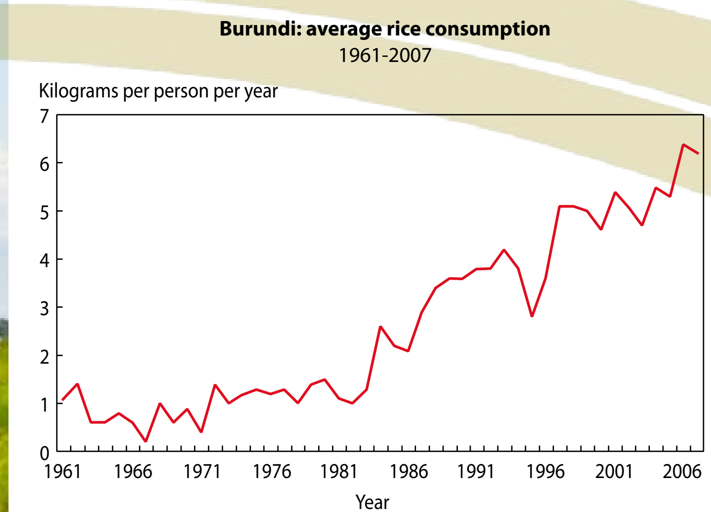
The institutions involved in rice research in Burundi are IRRI, the faculties of agricultural sciences at the University of Burundi and the University of Ngozi, and the Institut des Sciences Agronomiques du Burundi.

Rice breeding

Since 2009, IRRI's Burundi office has received and tested 670 rice varieties from IRRI headquarters. Variety IR77713 is due for release in 2011, pending national approval. It is suitable for irrigated areas on the Imbo plain, where it can yield an average of 6.5–7 tons per hectare, which is 1.5 tons per hectare more than the average yields of current popular local varieties. It matures 2–3 weeks earlier, providing grain and food earlier in the season and leaving more time to grow other crops. Another pending variety is IR79511.

Farmers have field- and quality-tested IR77713 and IR79511 and they have ranked both varieties higher in terms of grain quality (unmilled, milled, and cooked rice) than the current varieties.

IRRI continues to develop more high-yielding, high-quality rice varieties suited to Burundi, such as varieties with better tolerance of cold temperatures, salinity, and iron toxicity and resistance to blast and sheath rot.



EX-COMBATANT women in Burundi are learning to grow rice through IRRI.

NDUWIMANA JULIEN (2)

Rice production training for women

In 2010, 398 ex-combatant women were trained in a joint IRRI-CARE project in all aspects of rice production. (See *Women of war turn to rice in Burundi* on page 28.)

Tackling blast

Blast is the most serious disease that affects rice production in Burundi. A total of 29 rice lines, each containing one blast-resistance gene, have been field-tested in two hot spots in the country. Results showed that nine genes had resistance to local strains of leaf and neck blast. Breeding programs will now focus on these genes in an effort to improve resistance to local blast strains.

Collaboration and policy

IRRI works together with nongovernment organizations and national, regional, and international stakeholders in Burundi. It also plays an active role in the national committee for rice-sector development under the Ministry of Agriculture in Burundi.

Small-scale mechanization

IRRI has trained its technicians in Burundi to use its recently acquired two-wheeled hand tractor and thresher. Now, it aims to demonstrate the use of the equipment to farmers. Using these farm machines can save time, labor, and money, which can then help lower rice prices. IRRI is talking with the Burundi government to plan for increased efficiency in rice production through mechanization and also to look at alternative employment options for farm laborers.

Capacity building

IRRI is actively encouraging and supporting the education and training of Burundian rice researchers, technicians, and extension officers through short courses and graduate studies (MSc and PhD). In addition, the Institute is looking at developing a Burundi Rice Knowledge Bank—a Web-based repository of best practices and information about all aspects of rice production specific to Burundi. It also aims to extend its farmer field schools beyond the Imbo plain to other rice-growing areas in Burundi.

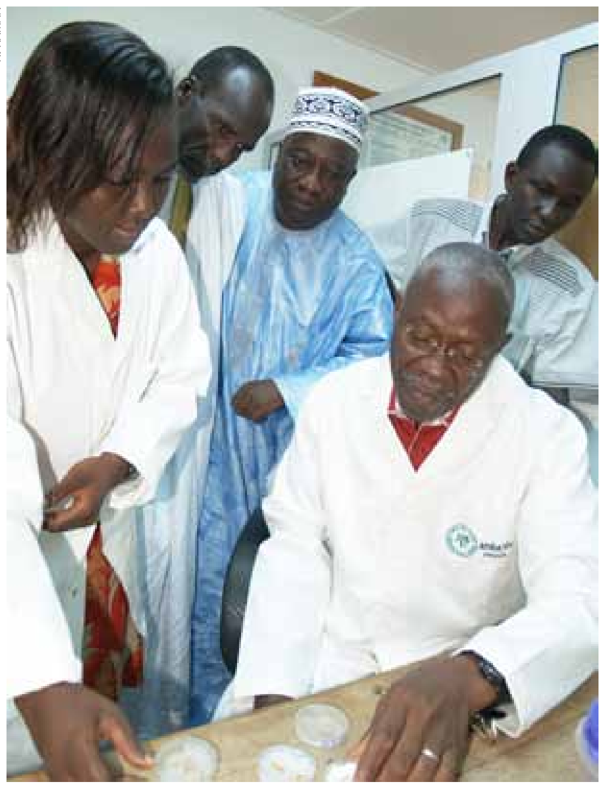
Unleashing the force

by **Savitri Mohapatra**

The Africa Rice Breeding Task Force responds to the call for an improved research and extension capacity on the continent through a collaborative approach to rice breeding

Rice breeders in sub-Saharan Africa (SSA) are an endangered species, according to Dr. Moussa Sié, Africa Rice Center (AfricaRice) senior scientist. "Since classical plant breeding is no longer fashionable, very few students are taking up this discipline," he remarked. "Even the handful of rice breeders who are working in national programs today are generally above 45 years old."

A survey, which was conducted among AfricaRice's member countries, verifies his observation. It showed that even a country the size of Nigeria has only two rice breeders. "Africa needs trained rice breeders—most African countries have none," said Kofi Annan, chair of the Alliance for a Green Revolution in Africa, pointing out the lack of national capacity in rice breeding.



R. RAMAN

SOME MEMBERS of the Africa Rice Breeding Task Force team (from *left to right*): Ms. Bernice Bancole, laboratory technician; Mr. Abdoulaye Sow, agronomist; Dr. Mamadou MBare Coulibaly, chair; Breeding Task Force; Dr. Jimmy Lamo, vice-chair, Breeding Task Force, and Dr. Moussa Sié, coordinator, Breeding Task Force.

Drawing attention to the desperate lack of research and extension capacity, which threatens to impede the progress in developing Africa's rice sector, participants of the Second Africa Rice Congress, held in March 2010, urged African governments and their partners to substantially strengthen the training and retention of new staff.

The Congress also called for the revival of the successful Task Force approach, introduced by AfricaRice in the 1990s. The Task Force consists of an Africa-wide collective research for development effort on critical thematic areas in the rice sector, based on the principles of sustainability, buildup of critical mass, and ownership by the national agricultural research systems (NARS).

The Africa Rice Breeding Task Force

In response to this call, the Africa Rice Breeding Task Force was launched in June 2010 to regroup scarce human resources devoted to rice breeding in Africa and help build a new generation of rice breeders across the continent.

The main thrust of the Breeding Task Force is to adopt a systematic collaborative approach to rice breeding that will build much-needed rice breeding capacity, facilitate access of African rice breeders to new materials, stimulate rice germplasm evaluation across the continent, and, in general, shorten the time needed to deploy new climate-resilient and stress-tolerant rice varieties for major production systems in SSA.

"The international agricultural research centers (IARCs) cannot do this alone nor can the NARS," said Dr. Sié, who is the overall coordinator of this Task Force, which is supported by the joint IRRI-AfricaRice Japan-funded breeding project.

Dr. Sié described the Breeding Task Force as a partnership of rice breeders from NARS and IARCs in Africa, which will provide synergy to breeding efforts across the continent, thereby increasing impact. To enhance communication and collaboration among all the partners of the Breeding Task Force, a dedicated Web site has been developed. (See www.africarice.org/afribreed/.)

The scope of the "force"

The Breeding Task Force covers mainly the four mega-environments in SSA—the rainfed lowland, irrigated, upland, and high-elevation ecologies. The challenges in these mega-environments are many and breeders must be able to tackle these challenges through improvements in productivity, stability and adaptability and grain quality of rice.

Responsibilities for the different mega-environments have been divided among AfricaRice and IRRI breeders based in Africa, who work closely with their NARS colleagues.

The main thrust of the Breeding Task Force consists of a 3-phase evaluation of rice breeding lines from IARCs and NARS, starting from the regional trial, then national trials, and participatory varietal selection trials (a rice garden followed by 2 years of mother/baby trials). These trials are done in multiple locations in different countries (please see the map of Africa Rice Breeding Task Force trial sites).

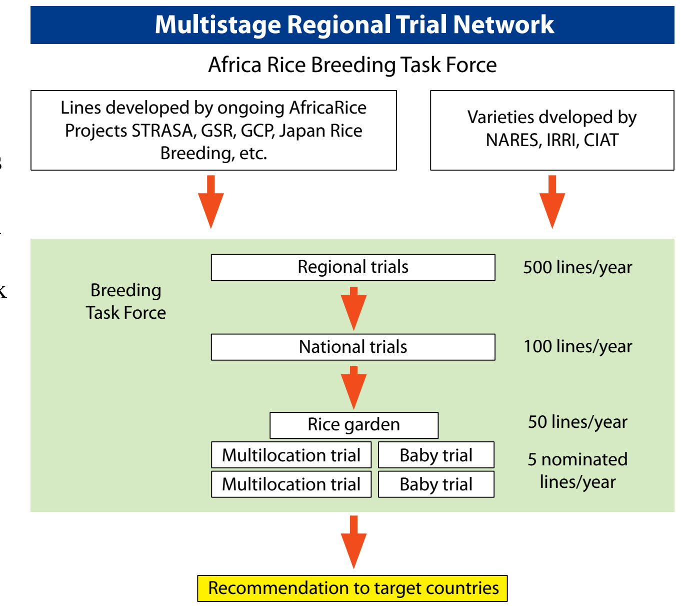
The International Network for the Genetic Evaluation of Rice (INGER)-Africa plays a key role in the multiplication and distribution of new seed for in-country hotspot testing and participatory varietal testing trials and genotype-environment analyses.

Takashi Kumashiro, regional theme leader of GRiSP Themes 1[1] and 2[2] and leader of the AfricaRice Program on Genetic Diversity and Improvement, explained that one of the unique features of such an approach is that the breeding lines that enter the Task Force are provided by not one but many institutes such as NARS in Africa as well as IRRI, the International Center for Tropical Agriculture (CIAT), and AfricaRice.

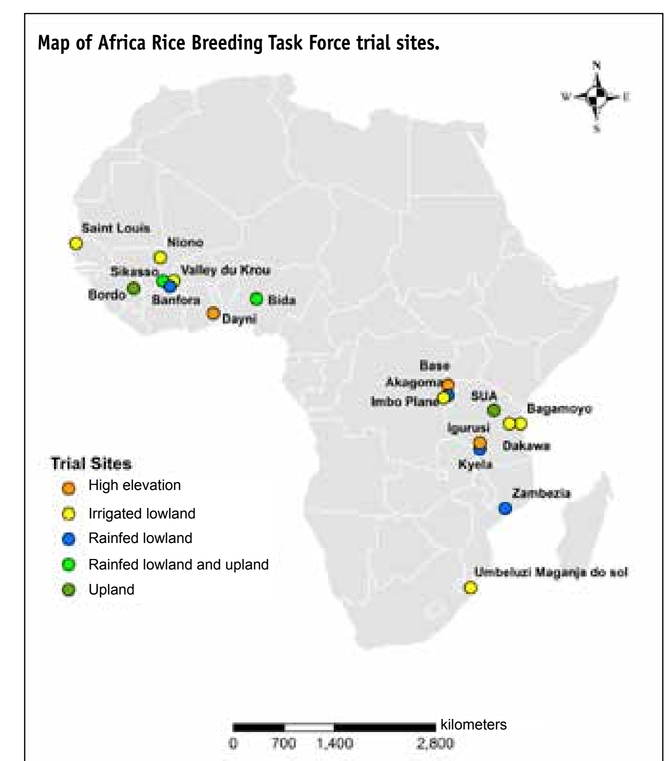
For example, in 2011, the breeding lines nominated for the lowland regional trial consisted of 13% lines from the NARS, 34% from AfricaRice, 14% from IRRI, and 39% from CIAT.

The Task Force thus enables the evaluation of many breeding lines with prior data on performance from different sources under different biophysical and socioeconomic conditions. "This feature is a bit like the Olympic Games," Dr. Kumashiro said.

The second unique feature is that the breeding lines will be cultivated at many sites and exposed to not just a few but many breeders from different institutes. The multiyear and multilocation trials are expected to enhance the quality of evaluation.



Map of Africa Rice Breeding Task Force trial sites.



This will result in increased credibility on recommended varieties as well as credibility of data accumulated. "We expect that this will shorten the time lag between the completion of breeding and the official approval for varietal release," Dr. Kumashiro stated.

Training programs for breeding, experimental design, and germplasm database management have been organized to upgrade the skills of rice researchers, including a training course held at IRRI in October 2010 for rice breeders from various Asian and African countries as well as a training workshop organized by AfricaRice in December 2010 to introduce the principles and new concepts of the experimental planning for plant breeding.

The Task Force will also support MSc and PhD students, and link up with Global Rice Science Scholarships (GRiSS) and other types of scholarships.

Spotting the champions

The key to the success of the Africa Rice Breeding Task Force will be timely and quality data collection, management, and interpretation for sound decisions on moving germplasm forward in the various trials, according to Dr. Kumashiro. "If that is done well, smart G × E (genotype by environment) analyses will enable us to select promising breeding lines to proceed to the next phase, that is, spot potential 'Olympic champions' early." Hopefully, these "Olympic champions" will help remove some barriers toward improved quality and quantity of rice production on the continent and put Africa on the map of potential sources of rice food security in the world.

[1] Theme 1: Harnessing genetic diversity to chart new productivity, quality, and health horizons.
[2] Theme 2: Accelerating the development, delivery, and adoption of improved rice varieties.

Technologies meet farmers

by **Trina Leah Mendoza** and **Grant Singleton**

Hundreds of thousands of Asian farmers are adopting a range of IRRC-facilitated technologies because of the many impressive economic, social, and environmental benefits

In Asia, where about 90% of rice is grown, hundreds of millions of rural poor grow rice on less than a hectare of land.

Producing affordable rice for the poor has been a challenge for the last 50 years. During the 2008 rice price crisis, changes in rice availability and price caused social unrest in some developing countries. The International Rice Research Institute (IRRI) estimates that an additional 8–10 million tons of rice need to be produced each year to keep rice prices stable.

The challenge now is to grow more rice with less land, less water, and less labor amidst climate change.

A regional approach to food security

In 1997, the Swiss Agency for Development and Cooperation (SDC) began funding the Irrigated Rice Research Consortium (IRRC), which provides a platform for partnership in research and extension in the intensive lowland irrigated rice-based production systems.

Initially, the IRRC focused on integrated pest management (IPM) and nutrient management. However, since 2002, the IRRC's research has featured water-saving technologies, labor sustainability (including direct seeding and weed and rodent management), postharvest management, crop health initiatives, and, recently, climate change in 11 countries: Bangladesh, Cambodia, China, India, Indonesia, Lao PDR, Myanmar, Sri Lanka, Thailand, Vietnam, and the Philippines.

The IRRC develops partnerships to identify the needs of rice farmers and potential solutions to their problems, and to facilitate the adoption of suitable technologies. It provides a range of technologies for rice farmers and other stakeholders in Asia to improve their

DAVID JOHNSON

A FARMER in Myanmar directly seeds his rice crop using a drum seeder.

livelihoods and increase rice production to maintain food security.

Hundreds of thousands of Asian farmers are now adopting these technologies because of impressive economic, social, and environmental benefits. This article examines some of these successes.

More rice, less water

Irrigated lowland rice is usually grown under flooded conditions, and kept flooded to help control weeds and pests. However, researchers found that rice needs to be continuously flooded only at the flowering stage. Through alternate wetting and drying (AWD), a water-saving practice, fields can be dried for 1–10 days before being re-flooded. Farmers can save 15–30% of water and still harvest the same yields. The water saved can be used to irrigate more fields, thus increasing overall production. If AWD were to be adopted all across Asia, the amount of water saved in one year would equal 200 times the water consumption of Paris for a year.

The IRRC Water-Saving Work Group led by IRRI water scientist Ruben Lampayan began studying AWD with Philippine partners and farmers in several national irrigation systems in 2002. In 2009, the Philippine government approved the endorsement of AWD for nationwide adoption. By July 2011, more than 80,000 Filipino farmers had adopted AWD.

Introduced in Bangladesh in 2004, AWD is now being promoted by government and nongovernment agencies. The secretary of the Ministry of Agriculture endorsed AWD in 2009, and directed the government's Department of Agriculture and Extension (DAE) to promote the technology nationwide. Along with other agencies, the DAE promoted AWD in over 50 districts in 2010. Field studies reported a decrease in pumping cost and fuel consumption, and an increased income of US$67–97 per hectare. In 2009 alone, partners reported 120,000 farmers adopting AWD.

The private sector promotes AWD by producing tubes that are used to monitor water levels in the field. Although thousands of farmers are practicing AWD in the country, a 2010 adoption study reported that, with millions of farmers still to be reached, adoption is in its infancy.

Around 40,000 farmers in Vietnam are practicing AWD, and more farmers are expected to be reached through a new IRRC-An Giang Department of Agriculture and Rural Development initiative: the One Must Do, Five Reductions Program. In 2010, Lao PDR, Indonesia, Myanmar, and Thailand started or successfully demonstrated AWD.

A FARMER from Vinh Phuc Province, Vietnam, uses the leaf color chart to check the nitrogen needs of his rice crop.

T.T. SON

Personalized precision farming

Most farmers lack knowledge on the most effective use of fertilizer. They either apply too much or too little, or apply it at the wrong time. Too much nitrogen fertilizer leads to increases in diseases and pests, damage to the environment, and low profit. For more than a decade, IRRI soil scientist Roland Buresh, leader of the IRRC Productivity and Sustainability Work Group, has been working with partners in Asia to provide site-specific nutrient management (SSNM) practices for rice.

Since 2003, correct fertilizer timing and application rates have greatly increased farmers' yields compared with traditional practices. Yield increases from adopting SSNM have improved net returns by $100 to $300 per hectare per year in China, India, Indonesia, Vietnam, and the Philippines. An impact assessment study on SSNM in the Red River Delta in Vietnam revealed a 2% and 3% increase in net present values for smallholder farmers in Ha Tay and Ha Nam provinces, respectively. Farmers who used SSNM reported a reduced use of pesticides.

Encouraging farmers to use SSNM has been a challenge because it is knowledge-intensive and many factors need to be considered, such as crop yield and the use of organic materials. This has slowed down farmers' adoption of these improved practices.

But, this speed bump did not slow down Dr. Buresh and his group, who looked for ways to make their science simpler for the farmers. The leaf color chart (LCC) was developed as a tool for farmers to assess the nitrogen needs of their crop. In Bangladesh, an estimated 600,000 farmers use LCCs, which has increased the efficiency of urea fertilizer use, enabling farmers to harvest more rice with less expense for purchased fertilizer.

Farmers learned about the use of potassium and phosphorus fertilizers, and gained new knowledge on other micronutrients. They were able to save $25 per hectare in production costs and harvested higher yields.

In 2008, SSNM principles were packed into a computer-based decision-making tool called *Nutrient Manager for Rice.* A farmer or extension worker only needs to answer about 15 questions and, within 5–10 minutes, a fertilizer guideline is provided for a field. In 2010, Web and mobile phone versions were developed in the Philippines. Web applications of the *Nutrient Manager* are now available for Guangdong, China, and Indonesia, while applications for Bangladesh, Vietnam, southern India, and West Africa are under way.

Saving labor and water costs

In the Indo-Gangetic Plain, which covers most of northern and eastern India, and almost all of Bangladesh, farmers face rising costs, waning productivity, worsening soil health, and labor shortages, as many people move to the cities to find work. Farmers depend on the monsoon rains, and they cannot plant if the rains come too late.

Led by IRRI weed scientist David Johnson, the IRRC Labor Productivity and Community Ecology Work Group promotes direct seeding of rice as an alternative way to establish a crop. In direct seeding, pregerminated seeds are sown directly into a nonflooded but saturated field, using a drum seeder.

Direct seeding allows quicker land preparation, and farmers can save 20% in labor costs and 30% in water costs. It takes 50 person-days to transplant a hectare of rice, but it takes only 2 person-days to directly seed using a drum seeder.

Direct-seeded rice matures 10–15 days earlier, allowing farmers to plant other crops earlier. In a partnership with India's Ramakrishna Mission in 2010, direct seeding (wet or dry) in 90 farmers' fields helped the early harvest of autumn and winter paddy, providing new opportunities for improved winter cropping practices through earlier timing of planting, new cultivars, and new crops. An earlier winter rice harvest meant earlier potato planting and a larger potato harvest, and reduced fungicide usage and drought risk.

In northwest Bangladesh, direct seeding combined with shorter duration rice varieties, appropriate weed management, and crop diversification is helping to ease *monga*, a seasonal hunger. Each year, farm workers suffer from *monga* from September to November as they wait for the wet-season harvest.

In *monga*-affected districts of Rangpur and Nilphamari, farmers who directly seeded their rice got higher net returns in both the wet and dry seasons. Yields of directly seeded crops in the wet season were higher by 493 kilograms per hectare, and total production costs were lower by $47 per hectare than on farms with transplanted rice. Planting of potato, maize, and wheat on time in the dry season allowed farmers to sell their crops at higher prices, because they were able to harvest earlier when supply in the market was still relatively low. On-time planting of these dry-season crops also resulted in better yields. Net incomes of farmers who directly seeded during the wet and dry seasons were higher by $441 per hectare than for farmers who transplanted.

With the earlier harvest of the directly seeded rice crop in the wet season, 55–59 person-days per hectare can potentially be hired during harvesting, thus easing the problem of unemployment.


MEN, WOMEN, and children—and their dogs—hunt rats together in An Giang, Vietnam.

Ecologically based rodent management

It is not uncommon for farmers to lose half of their entire crop to rats, because rat damage is usually patchy and family rice plots are small. Surprisingly, only 10% of the many different species of rodents are pests in agriculture. The challenge is to develop ways to control the pests without greatly affecting those that are beneficial in our environment.


RAT POPULATIONS can be successfully managed if farmers work together as a community—applying their control at the right time and in the right habitats.

CHRIS QUINTANA

Farmers are adopting a simple, environment-friendly community method called ecologically based rodent management (EBRM). With EBRM, farmers are encouraged to conduct control methods as a community, such as planting synchronously and hunting rats together. EBRM reduces rodent damage by 33–50%, and increases rice yield by 2–5%. It also reduces rodenticide use by 62–90%.

EBRM has been adopted as the national policy for rodent management in Vietnam, Indonesia, and Myanmar. It also was recently included in a national integrated crop management program in Indonesia, which was promoted through 50,000 farmer field schools in 2009 and 2010.

The impact of rodent outbreaks in different parts of the world was highlighted in the 2010 book *Rodent outbreaks: ecology and impacts,* published by IRRI.

Reducing postharvest losses

Asian rice farmers lose 30–50% of their earnings from harvest to market. IRRI postharvest specialist Martin Gummert leads the IRRC Postproduction Work Group in tackling problems on postharvest losses by providing best practices and technologies to farmers and other stakeholders. Since 2005, activities have been funded by SDC and the Asian Development Bank.

The mechanical flat-bed dryer, which produces better quality rice than sun drying, was introduced in Cambodia, Myanmar, and Lao PDR. Farmers' groups and private companies themselves provide funds to install more dryers in different provinces. As many as 35,000 farmers in Myanmar benefited from using flat-bed dryers. In Cambodia, traders pay 20% higher for dry paddy, and an additional 10–12% for mechanically dried paddy. In the Philippines, third-generation flat-bed dryers were transferred from Vietnam, and adaptation trials are ongoing.


IN NORTHWEST Bangladesh, direct seeding, combined with early-maturing varieties, appropriate weed management, and crop diversification, is helping to ease seasonal hunger called *monga*.

T. MENDOZA (2)

Stakeholders in Cambodia, Indonesia, Myanmar, Lao PDR, Vietnam, and the Philippines tested small-scale hermetic (airtight) storage systems for grains and seeds. Local distributors were established as well. An impact survey indicated that Cambodian farmers who use IRRI Super bags reduced their seed rates by 22 kilograms per hectare. In Myanmar, a locally manufactured bag for rice seeds was developed, with over 10,000 bags sold to farmers.

Partners share their experiences in using these postharvest technologies through national learning alliances (LA) in Cambodia, Vietnam, and the Philippines. Five regional LAs have been established in Vietnam.

Successes in Sulawesi

Through country outreach programs in Myanmar, Vietnam, Indonesia, and the Philippines, combinations of IRRC technologies are showing positive results in trials in farmers' fields.

From 2008 to 2011, an IRRC-led project funded by the Australian Centre for International Agricultural Research focused on raising rice productivity in South and Southeast Sulawesi, two major rice-producing provinces in eastern Indonesia.


AFTER A SUCCESSFUL field trial, the women in Bone, South Sulawesi, proudly carry the season's bountiful rice harvest.

M. CASIMERO

Farmers in four villages tested AWD, integrated pest management, and direct seeding (using a drum seeder) with appropriate weed management. EBRM, storing seeds using the IRRI Super bag, and fertilizer management (using a soil test kit and the computer-based *Nutrient Manager*) were also benchmarked.

Farmers obtained a substantial increase in yields of 0.5 to 2.3 tons per hectare. The increase in mean farmer income ranged from 22% to 566%, significantly higher than the 10% target of the project.

The number of farmers adopting direct seeding almost doubled in Southeast Sulawesi, from 26% in the 2008 wet season to 48% in the 2010 wet season.

None of the farmers had heard of the *Nutrient Manager* in 2008, but, in 2010, 14–55% of the farmers had heard about it and 10–20% had used it.

Compared with farmers in control villages, the number of farmers with improved knowledge on key insect pest management principles doubled. For water management, none of the farmers had heard of AWD in 2008, but, in 2010, 19–80% of the farmers in the project villages had adopted AWD.

The project's adaptive research approach was integrated into a national program called Integrated Crop Management-Farmer Field Schools.

Closing yield gaps in Southeast Asia

The IRRC has proven to be an effective platform for delivering new technologies to small-scale rice farmers across Asia. With over a decade of valuable learning experiences under its belt, the IRRC envisions that it will continue to provide scientific leadership and essential networks for environmentally sustainable increases in rice production in Southeast Asia's main rice bowls.

The impacts have been impressive so far, and the IRRC, through its national partners in both the public and private sector, has a key role to play in facilitating food security in the region.

Dr. Singleton is coordinator of the IRRC.


CHILDREN AND their families across Asia have more reasons to smile as the IRRC continues to help bring rice to their tables.

GRANT SINGLETON

Isagani Serrano

The crowded city of Dhaka in Bangladesh represents rapid population growth in urban areas in less developed countries until 2050. These urban areas are the most vulnerable to insufficient food security. During the 2008 food price crisis, the urban poor were hit the hardest.


Women of war turn to rice in Burundi

by **Sophie Clayton** and **Alaric Francis Santiaguel**

Ex-combatant women in Burundi try a second chance for a peaceful life by turning to rice farming

Burundi is a small landlocked country in Central Africa. Long-standing tribal conflicts in the country broke out into a civil war in 1993 that lasted 12 years and resulted in more than 200,000 deaths.

In 2006, a year after the conflict ended, a horrendous 83% of Burundians were found living below the international poverty standard of less than US$1.25 a day.[1] By 2010, Burundi ranked alongside its neighbor, the Democratic Republic of the Congo, as the poorest country in the world.[2]

Women of war

During the war, women in Burundi not only hid, fed, and looked after male combatants—including their own sons, brothers, and husbands—but they were also recruited to take up arms themselves.

The United Nations (UN) news service, IRIN, recorded an interview with Annabelle Nshimirimana, an ex-combatant in Burundi:[3]

"We used to leave home [carrying food] at around 8 p.m. and walk and walk; we arrived at their [Forces nationales de liberation] hiding places at dawn.

"The next night, we walked back home, taking care nobody observed our absence. It was a difficult task because it was a long way through the mountains. Sometimes, we were ambushed and forced to fight."

After the war, many ex-combatant women were left scarred both physically and mentally and without money or resources to rebuild businesses or livelihoods. And, they became social outcasts.

The UN and other organizations work with governments to reintegrate ex-combatants into society. But, in Burundi, to be included in the UN's Disarmament, Demobilization, and Reintegration program, ex-combatants had to either own or have direct access to a firearm themselves or pass a proficiency test in handling weapons.[4] This excluded many women ex-combatants from the formal reintegration programs.

Replacing bullets with skills

In 2009, a team of organizations, with financial support from the Howard Buffet Foundation, got together to help those "unofficial" ex-combatant women in Burundi who had fallen through the gaps. They provided a holistic approach to empower these women economically and socially.

CARE, Survivor Corps, and CEDAC[5] focused on the psychosocial aspects of reintegration, while CONSEDI[6] provided vocational training for the participants' economic development. The International Rice Research Institute's (IRRI) role was to improve their income by teaching them how to grow rice and by introducing new rice production technologies.

Rice is an increasingly important crop in Burundi (see *Country snapshot* on pages 18) and the women traditionally provide food for their families. They are the main source of agricultural labor for food production.

"IRRI and CARE organized about 400 ex-combatant women into 10 groups to grow rice on 10 hectares of land," said Mr. Joseph Rickman, IRRI's regional coordinator for East and Southern Africa. "The project supplied the necessary start-up financing for renting land, seed, and fertilizer, while the women provided the labor. Each group was visited by the project team weekly to provide the necessary training."

"With IRRI's assistance, I produce rice myself and I can eat rice with my children whenever I need it."

Ms. Elisabeth Nibigira

The women were taught how to grow rice through a farmer field school. Representatives of the women's groups learned all aspects of rice production, from land preparation to rice harvesting and drying. Back in their own fields, these women, in turn, shared their knowledge with their colleagues.

"From the profits the women made in the first season, they were able to pay for their own land and inputs the following year," said Dr. Joseph Bigirimana, liaison scientist and coordinator for IRRI in Burundi.

"These ex-combatant Burundi women are turning their own lives around—they just needed a hand to get started," he added. "Now, they are helping our country attain rice self-sufficiency and build a more stable future for all Burundians."

In their own words

During a group interview with women involved in the project, they all indicated that the most important aspect of the project was giving them access to land, which they would not have had without IRRI, CARE, and the cooperation of the Burundian government.

Ms. Scola Simbandumwe, one of the participants, explained: "With IRRI's assistance, we were able to get money to rent land for rice growing, which helped us produce rice for family consumption.

"We have gained technologies to improve our rice production," she added. "We now use less seed for the same area, thanks to IRRI's assistance. We also use enough fertilizer, unlike before, when we used small quantities because we could not pay the cost."

Elisabeth Nibigira, mother of four children and one of the farmers in training, said, "With the IRRI project, I now feel reintegrated into society. I do not feel afraid of people anymore, unlike during my combatant life; and other people no longer regard me as an excluded ex-combatant.

"When I was not growing rice," she added, "I used to eat rice only on feast days or when I got my pay from hard work. Now, with IRRI's assistance, I produce rice myself and I can eat rice with my children whenever I need it."

The women are very enthusiastic to keep developing their skills and their rice production. They want to mechanize and improve the efficiency of their operation to increase profit and reduce labor.

"The first thing we would like to have is a milling machine because we will benefit from it as we will not have to pay for milling," said Ms. Nibigira. "Other farmers will come to us and mill their rice, which will provide us with money to feed our family. Moreover, we could then produce rice bran for our cattle or for sale."

Participatory science

IRRI and students from the University of Burundi also conducted participatory variety selection trials that included the women in choosing the best rice varieties from field tests that compared local and potential new varieties. Engaging them in the selection process helps build project ownership and their knowledge about which varieties are best and why.

Varieties are tested for their capacity to perform well in different growing environments across Burundi and for traits, including resistance to local diseases such as sheath rot and blast, and tolerance of salinity, cold, and iron toxicity. A number of new varieties especially suited to Burundi are expected to be released soon as an outcome of these trials.

The results from these on-farm trials will also expedite the registration of new varieties, which the women's groups can use to produce more seeds.

The future

In collaboration with the Faculty of Agriculture at the University of Burundi, IRRI works to continue the project based on its outstanding success. But, it also seeks funding to include more women in the program and support the existing women to further develop their rice production skills and improve their access to technology.

1 The World Bank, http://data.worldbank.org/.
2 Central Intelligence Agency (CIA): The World Factbook, http://snipurl.com/cia-facts.
3 IRIN news item: Female ex-combatants picking up the pieces (Burundi), http://snipurl.com/burundi_women2.
4 United Nations Disarmament, Demobilization, and Reintegration–Burundi Programme, http://snipurl.com/burundi_women.
5 Le Centre d'Encadrement et de Développement des Anciens Combattants (Council for the Training and Development of Former Combatants).
6 Council on Integrated Development, Bujumbura, Burundi.

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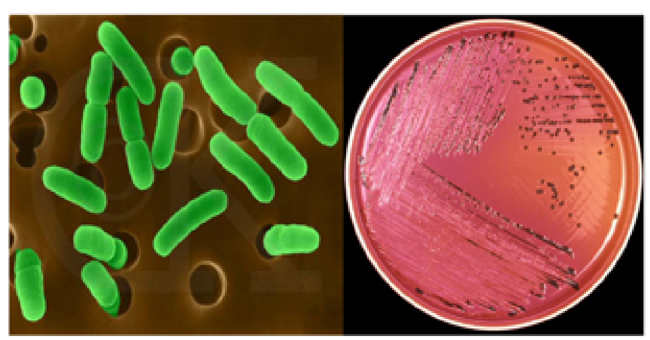

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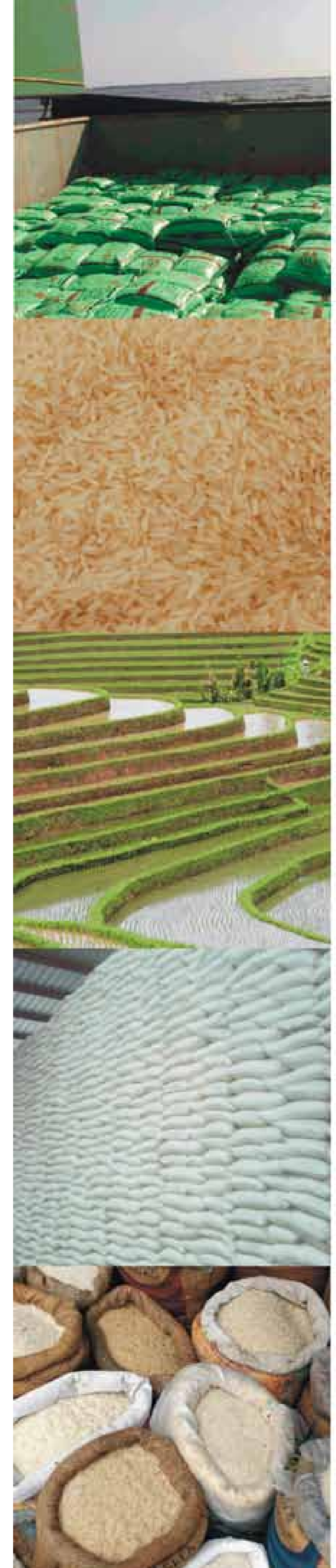

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Letting nature manage its battles

by **Ma. Lizbeth Baroña**

IRRI offers an option to better manage pests in ricefields by letting nature's biological foot soldiers do the job of controlling pests.

HEALTHY RICE landscapes. Planting different types of flowering plants alongside rice can help encourage predators and parasitoids that prey on pests, including planthoppers.

KL HEONG (2)

SPIDERS AND other "friendlies" help increase rice's chances against planthopper outbreaks.

SYLVIA VILLAREAL

The efforts to manage rice pests such as planthoppers have taken on a simple message: let nature have its way in your fields. In essence, leave the friendlies such as spiders, predatory bugs, and parasitic wasps alone, and you increase rice's chances against planthopper outbreaks.

As straightforward as the message is, doing away with old-time practices of finding assurance from insecticides is not.

In a statement[1] calling for support on pesticide regulation and for a ban in the use of specific insecticides in rice that contribute to planthopper outbreaks, the International Rice Research Institute (IRRI) has offered alternative practices to better manage pests and has called on its partners to join its concerted efforts to change mind-sets.

Asia bears hopper brunt

The message comes as rice losses from planthopper outbreaks spread across Asia. Indonesia's Western, Central, and Eastern Java lost more than 25,000 hectares of rice to hopperburn and virus diseases in 2010. Planthoppers and associated virus diseases have also intensified in central Thailand, the southern provinces of China, and northern Vietnam.

Between 2009 and 2011, rice production in Thailand suffered huge losses caused by brown planthopper (BPH) and two viral diseases this pest transmits called grassy stunt and ragged stunt. More than 3 million hectares were infested, and more than 1.1 million tons of paddy with an export potential of US$275 million were lost. The infestation continues to cause misery to farmers.

In 2009, a new virus disease transmitted by the whitebacked planthopper was detected in Vietnam. Originally discovered in China in 2001, the southern rice black streak dwarf virus had spread into most provinces in the Red River Delta and further south into central Vietnam.

This virus is now endemic in most of China's southern provinces, namely, Hainan, Guangdong, Guangxi, Yunnan, and Fujian. Planthopper damage costs Chinese rice farmers about 1 million tons of rice annually. However, in 2005, these losses increased to 2.5 million tons.

In 2005, Vietnam lost about 400,000 tons of rice paddy and, as the problem persisted, this prompted the country to suspend its exports in 2007. This was due to attempts to protect the domestic supply, which caused volatility in rice prices as happened in the 2007-08 rice price crisis, prompting warnings from the World Bank that millions would be pushed further down the poverty line.

In 2009, an estimated 300,000 hectares were heavily infested in China and Vietnam, and more than 6,500 hectares suffered complete crop failure.

Ecosystem breakdown

Planthopper outbreaks are primarily caused by a breakdown of "ecosystem resilience" or biological control functions in the rice landscape.

IRRI entomologist K.L. Heong said that a ricefield, left on its own without interference from chemicals, has its own foot soldiers that provide protection from pest outbreaks.

A ricefield is a patchwork of rich diversity in which spiders, aquatic bugs, parasitic wasps, and predatory bugs thrive. These are called natural enemies—enemies of pests, that is.[2]

An irrigated rice ecosystem in the Philippines, for example, is home to nearly 700 organisms, most of which are friendly to rice. Each has a role that makes for a delicate balance, making the landscape environmentally sustainable.

"Biodiversity is about balancing the positives and the negatives," said Dr. Heong. "It is about roles, interactions, and stability.

"Without natural enemies, planthoppers multiply and can overrun a ricefield, causing an outbreak," he added.

Ineffective pesticide use

Natural enemies keep the pest population in check. The whole system starts to fall off-balance, however, the moment chemicals are sprayed.

Farmers often spray insecticides in the early crop growth period to control leaf feeders, such as the leaffolder. The chemicals used at this time also kill beneficial parasitoids and spiders—natural enemies of hoppers. Such preventive sprays, especially with broad-spectrum insecticides, render rice ecosystems extremely vulnerable to planthopper outbreaks and actually make

[1] http://snipurl.com/planthoppers.

[2] Biodiversity: Maintaining the balance: IRRI (1997-1998): http://snipurl.com/biodiversity_balance.

planthopper outbreaks ten times more likely to occur.

Even when farmers are trying to target planthoppers with their insecticide application, their methods may be ineffective—often applying insecticide on top of the rice canopy where it doesn't reach the nymphs hiding beneath the canopy, and with poor equipment that delivers large droplets.

Pesticides: consumer good or regulated material?

No amount of solid, environmentally sustainable practice will work, however, if farmers are not weaned from the belief that they need to use chemicals to control pests.

"Effective advertising has led our farmers to believe that they need chemicals to solve their pest problems," laments Dr. Heong. "Misuse is created by pesticides being marketed as fast-moving consumer goods and farmers relying mainly on village pesticide retailers for advice."

As consumer goods, pesticides are marketed using emotional appeals and even give-aways, effectively putting reason on the back burner.

Dr. Heong believes that pesticide use must be knowledge-based in order to preserve balance in the rice ecosystem and therefore prevent outbreaks.

In a report published on ricehopper.net, Dr. Heong said, "Insecticide misuse is an important cause of the current planthopper outbreaks in Asia, namely, Thailand, Indonesia, and the Philippines."

A crucial step against chemicals

Earlier in 2011, Thai scientists reported that huge populations of BPH had infested rice fields in the provinces of Ayutthaya, Chai Nat, Suphan Buri, Ang Thong, Sing Buri, and Pathum Thani, destroying thousands of hectares of areas planted to rice.

In March 2011, the report said, "Damages reported in 11 provinces affected 104,000 hectares, and further hopper outbreaks would seem inevitable. Numerous farms in the northern provinces, like Pitsanuluk, are now heavily infested."

PESTICIDE SUPERMARKETS. The overuse and misuse of insecticides are a key factor in planthopper outbreaks. Regulating the marketing and use of pesticides will help farmers manage pests more effectively.

In June 2011, Thailand's Minister of Agriculture and Cooperatives Theera Wongsamut announced a $12.8-million initiative to stop the use of two outbreak-causing insecticides—cypermethrin and abamectin—in Thai rice crops to control the BPH outbreaks, and to implement a campaign to improve pest management practices in rice. These efforts are supported by both IRRI and the Thai Agro Business Association—Thailand's pesticide industry association (see *Thailand moves to stop insecticide use in rice* on page 5 of *Rice Today* Vol. 4, No. 3).

IRRI Director General Robert Zeigler applauded the action of the Rice Department. "It is of international significance that Thailand will undertake this initiative because, as the world's largest exporter of rice, it is recognized as a global leader in the rice industry," he said.

Action

In its action plan[3] that seeks to solve the hopper problem sustainably, IRRI has proposed the restoration of biodiversity in ricefields, as well as building ecological resilience.

Specifically, IRRI recommends ecological engineering approaches that introduce landscape elements such as flowers and other plants to promote the buildup and sustenance of a healthy population of natural enemies of planthoppers.

IRRI also recommends the use of resistant varieties, or a combination of varieties, that are tolerant of the local or invading planthopper populations. However, to prevent the hoppers from developing resistance to a variety, farmers are advised against using the same variety for more than 2 years.

Synchronous planting and fallow periods of 1 month in between successive crops of rice, as well as crop diversification schemes, are also included in IRRI recommendations.

To support farmers in their on-ground activities, IRRI is also calling on its partners in national governments and the private sector to regulate the marketing and improve the use of insecticides.

The call is to shift the classification of pesticides away from consumer goods to regulated materials, and to ban or restrict the use in rice of broad-spectrum pesticides that contain active ingredients known to contribute to planthopper outbreaks—cypermethrin, deltamethrin, abamectin, and chlorpyrifos.

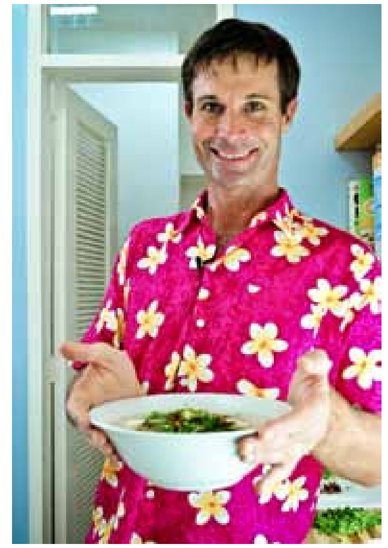
Certifying and training pesticide retailers is also recommended to prevent sales of fake, banned, or unapproved products, and to foster the promotion of integrated pest management and proper pesticide use.

[3] http://snipurl.com/planthoppers.

What's cooking?

Laotian congee

by Leigh Vial



CHRIS QUINTANA (3)

Congee is the first meal of the day in many parts of Asia, and it makes a wonderful snack too. It is simply rice cooked in an excess of stock such as pork or chicken, with a range of savory additives. In Lao PDR, it is called *khao piak khao*, which literally means "wet rice." Both the stock and rice require some forward-planning, but it is well rewarded.

Dr. Vial came to the Philippines to head IRRI's Experiment Station in early 2011, after a 15-year career in the Australian rice industry, then 3 years pursuing a PhD and consulting to an Australian Centre for International Agricultural Research (ACIAR) lowland rice project in Lao PDR. Three years in Lao PDR exposed him and his family to the full range of Southeast Asian cooking. Congee proved a particular favorite for him, his wife, Sue, and two boys, Digby and Rory.

Boil stock

In a large pot, put 4–5 liters of water, then add:
A large piece of pork or chicken (up to 1 kilogram)
A few pieces of ginger, according to taste
2–3 whole onions, according to taste
2–3 whole small coriander plants

Boil slowly for 30–60 minutes. Powdered stock with added ginger is a much quicker option if you have less time.

Cook rice

Add a cup of rice (good for four persons) to about 2 liters of stock, but you can dilute the stock according to taste. Some people use some or all glutinous rice for a creamier texture. Boil slowly for 30–60 minutes. Rice can be cooked ahead of time (cooked in the standard way, one part rice and one part water), then simmer the precooked rice in stock when required.

Add toppings

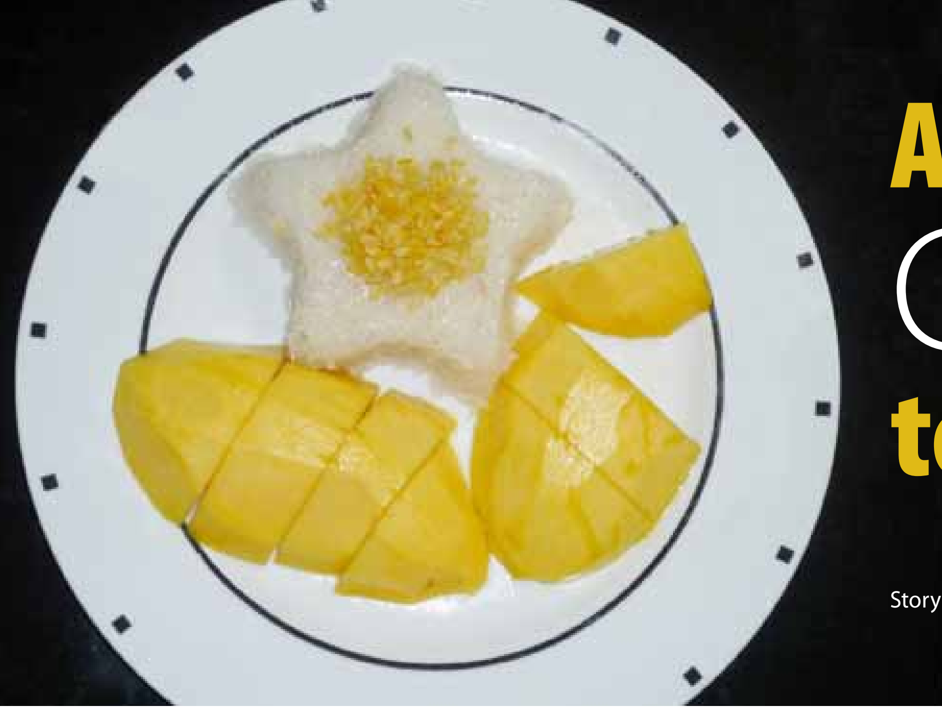
Some suggested toppings are the following, for one person:
A tablespoon of fried garlic
A tablespoon of chopped spring onions
A tablespoon of chopped coriander
One sliced boiled egg
A pinch of dried or fresh chillies

Add ground pepper and soy sauce to taste.

Note: Other toppings are limited only by your imagination!

Source of the recipe: Thanks to my instructor Deng, the proprietor of Kung's Café Lao, just around the corner from Wat Simuang, Vientiane, Lao PDR.

Watch Dr. Vial demonstrate how to prepare this dish in a 8:52 video on YouTube at http://snipurl.com/lao_congee.



A consumer's GUIDE to rice

Story and photos by **John R. Leeper**

A long time ago, I was told, "Rice is to Asians what wine is to Europeans." Wine is linked to Europe's culture and cuisines as closely as rice is to Asia's. Both rice and wine have myriad differences, but both are influenced by the environmental conditions under which the crop is grown. Each domesticated rice variety has qualities or traits that differentiate it from all others.

A. Short B. Medium C. Long

Grain shape

Rice grains can be round to long, straight, or curved. They can be short, medium, and long. A simple way to determine a rice variety's length is to place a grain vertically beside grains of the same variety that are stacked on their sides. Then count the number of grain widths it takes to equal a grain's length. This method works for unhulled, dehulled, and milled grains alike. When the length of the grain is no more than twice its width, it is short grained. Medium-grain rice is characterized by its length being between two and three times its width. And, long-grain rice has a length more than three times its width.

Parboiled rice

Parboiling is a method of partially cooking or gelatinizing the rice grain in its hull. For millers, gelatinization helps mend the grain's cracks and fissures, and this improves the head rice or whole grain milling rate. Parboiling also transfers some of the nutrients from the outer germ layer, which is milled away, to make polished or white rice, into the endosperm. Milled parboiled rice tends to have a slight yellowish or tannish color. It also tends to take a little more water and cooking time. When cooked, parboiled rice is less sticky than its nonparboiled counterpart.

Milling quality

Rice quality also depends on milling. The milling process involves more than whitening or polishing—the mechanical removal of the pericarp from the endocarp. It begins with cleaning the paddy or harvested grain. This step may be followed by parboiling. Finally, the bran is milled from the grain. On average, with modern milling equipment, dehusking removes 20% of the paddy weight. An additional 10% is removed after milling, leaving 70% of the original weight. Modern rice mills also use sophisticated sorting machines that separate broken, chalky, speckled, and off-color grains from the whole-grain head rice. A head rice output of 55% to 60% is considered good for modern equipment.

In many areas around the world, rice is packaged and labeled according to grade, variety, percent of broken, and off-color grains present. White-rice quality increases with the number of times the grain passes through the mill and more starch layers are removed. This is an important aspect in making *sake*, a Japanese rice wine for which the liquor's quality is judged on the number of milling cycles, among other factors.

Grain color

When milled, rice varieties produce white grain. Brown rice, also known as husked rice or cargo rice, is unmilled, has the bran attached to the grain, and is one of the healthiest forms of rice to eat. A majority of the vitamins in rice are in the bran and are lost with milling. Rice is milled because the oils in the bran readily oxidize, turn rancid, and impart an off-flavor. Storing brown rice in the freezer will slow the process of rancidification. Rice bran oil is one of the healthiest plant oils and is high in heart-healthy tocopherols and tocotrienols, which are members of the vitamin E family. Rice bran oil extracted by some modern mills can be used in high-quality cooking oil, pharmaceuticals, and cosmetics. The bran is also used as animal feed and would be an excellent source of vitamins and fiber if the oil could be stabilized.

Rice starch

Amylose and amylopectin are the two basic starches that make up the rice endosperm. Amylose molecules are lightly branched chains of glucose monomers. Amylopectin, on the other hand, is made up of branching chains of the glucose molecule and is more easily digested than amylose. Long-grain rice typically has more amylose and is less sticky than medium- and short-grain rice, which tend to have progressively higher amylopectin content. Sticky or glutinous rice has no or a negligible amount of amylose. Rice is gluten-free and is considered hypoallergenic.

Rice starch can be milled into flour or used in making everything from cosmetics to tablets. Rice starch granules are particularly good for making puddings, confections, and gravies, for which smoothness and texture are important.

Cooked rice may also be enzymatically digested to produce rice syrup, or it can be fermented to produce alcohol. Sake is the most famous of the rice-based alcoholic beverages.

Enriched and fortified rice

Packaged rice may be labeled as either enriched or fortified. These represent two methods of adding back the vitamins and minerals that are lost in the milling process, which produces white or polished rice.

Enriched rice is simply rice overcoated with vitamins and minerals. It is recommended not to wash enriched rice because this removes these vitamins and minerals.

Fortified rice is made by blending vitamins and minerals with rice flour and extruding the dough through a granulator to create an artificial rice grain. These vitamins and minerals are then blended with the milled rice at a ratio of normally one or two fortified grains per hundred grains of milled rice. Fortified rice can be washed prior to cooking without a significant loss of vitamins and minerals.

Cooked rice

No single method of cooking rice works well for all varieties and cuisines. The optimum amounts of ingredients, temperature, and time allowed for cooking will vary with the variety, with the food being prepared, and with the equipment and method of cooking. Other ingredients, such as milk and cream, can be added before, during, or after cooking to add color, flavor, or texture.

When I was a child, my mother cooked rice on the stove in a special rice pot with a double lip. A crust of brown, crispy, partially caramelized rice would frequently form at the bottom of the pot. This layer was called "*koge*" (pronounced "ko-gay"), Japanese for burned, and was a favored childhood delicacy. Unfortunately, with the modern rice cookers, koge rice is a thing of the past.

Packaged precooked rice dishes, now in the market, need to be reheated only by placing the package in boiling water or the microwave.

The taste of rice

The taste of rice is the marriage of two senses: flavor and texture. A majority of rice varieties are nonaromatic and have subtle flavors that do not rely on aroma. Aromatic rice varieties, on the other hand, derive much of their distinctive flavor from the mixture of volatile chemicals. Cooked rice can run a wide gamut of textures. It can be waxy, firm, sticky, smooth, or creamy.

At times, I'm asked what my favorite rice variety is. I always reply that I have no favorite; it depends upon what I am eating. Just as Basmati or Jasmine rice will not make good sushi or donburi, Nihonbare rice does not make the best Biryani rice, a popular Indian dish, or *khao pad gai*, a Thai rice dish. Each variety was developed for a consumer within a specific culture and cuisine. This being said, it gets down to personal preferences. Does this not hold true for wine as well?

Dr. Leeper is rice technology leader for RiceCo International, Inc.

Celebrating rice, American style

by **Alaric Francis Santiaguel**

Rice may be the staple food of Asia, but in the city of Crowley, Louisiana, it is as American as apple pie

One would imagine that an event called the International Rice Festival would be held somewhere in Asia. But, for the past 75 years, Crowley, the largest city in Acadia Parish in the heart of southwestern Louisiana, has been celebrating rice with as much fanfare as the 4th of July. The people of Crowley have been hosting the International Rice Festival every October and this event draws more than 150,000 visitors from around the world.

A festival is born

Accounts vary on how and when the rice fair started.[1] One version says that the first Rice Festival was held in 1927, a brainchild of Commissioner of Agriculture Harry Wilson. In another version, the festival is credited to former Louisiana Governor Richard Leche, who, in 1937, after watching a young lady in a rice costume pose for photographers to publicize Louisiana's crops (rice was considered one of the most important), reportedly jumped up and said, "Let's have a Rice Festival!"

Either way, the citizens of Crowley welcomed the Rice Festival with overwhelming enthusiasm, making it a success from the get-go. The 1937 celebration kicked off with a concert by the 204-piece Louisiana State University Band. Lampposts were decorated with stalks of rice. Nearly 35,000 people participated. The events included the coronation of the first national Rice Festival Queen, best rice costume and window display contests, and a grand parade.

Out of Africa

How did rice find its way to Louisiana in the first place? And, why does it play such a big part in Crowley's culture? The answers go back to the 1700s. According to American professor and author Gwendolyn Hall,[2] rice arrived via slave-trading ships from Africa that landed in what was then known as French Louisiana (see *Carolina Gold and Carolina White rice: a genetic odyssey* on pages 20-22 of *Rice Today* Vol. 9, No. 4).

Dr. Hall said that, after the French settlers were wiped out by the Native American Natchez tribe, French Louisiana survived because of the rice-growing technology of African labor. "The introduction from Africa of rice seeds (*Oryza glaberrima*) and of slaves who knew how to cultivate rice assured the only reliable food crop that could be grown in the swamplands in and around New Orleans," she explained. By 1720, rice was being grown abundantly along the Mississippi River and, within just a few years, it became an export commodity.

Today, Louisiana is the third-largest rice producer in the United States, with primary rice production and milling centered in the southwestern part of the state, according to the USA Rice Federation (www.usarice.com).

From swampland to Small Town USA

The city of Crowley was originally a *Cajun Prairie,* a wide treeless coastal expanse heavily populated with tall grasses growing on deep, well-drained, and fertile top soil.

The official Web site of Crowley[3] described the place as "ghostly prairie lands of virgin soil that displayed only a desolate and parched canvas of barren lands." Founded by two brothers, C.C. and W.W. Duson, in 1886, it took more than 100 men, armed with machetes and cane knives, working feverishly under the hot summer sun to clear the overgrown brush from the undeveloped land, then known as Crowley Switch.

Crowley became famous for its "providence" rice, the name given to the harvest that came from rice seeds casually thrown by farmers into the wetlands near bayous or ponds that featured heavy clay soil.

[1] http://ricefestival.com.
[2] Hall G. 1992. Africans in Colonial Louisiana: The Development of Afro-Creole Culture in the Eighteenth Century. Baton Rouge: L.S.U. Press. 423 p.
[3] http://crowley-la.com/GOVT.html.

Heart and "Sol" of rice in Crowley

Then came Salmon Lusk "Sol" Wright. Mr. Wright was a rice farmer and scientist who developed Blue Rose, a "purebred American rice" variety, which is credited with the revolution of the rice industry in Crowley. This high-yielding variety produced chalk-free, medium-sized grains of uniform shape, color, and texture.

Sol's passion for rice, along with improvements in irrigation, harvesting, and the construction and establishment of rice mills throughout the emerging city, spurred a tremendous growth in Crowley's rice industry between 1890 and 1905. Since then, rice became intertwined with the city of Crowley, the self-proclaimed Rice Capital of the World.

"Rice has always been a way of life in Crowley," said Charlotte Jeffers, the city's tourism coordinator. "To start with, our ideal climate, perfect land composition, and plentiful access to water for irrigation made for perfect rice-growing conditions.

"The combination of the prolific rice strains developed by Mr. Wright, several large milling facilities, and its central location make the perfect recipe for the city whose slogan is 'Where life is rice and easy,'" she added.

In a fitting tribute, Sol Wright and his daughter, Edith, were chosen as the King and Queen of the Rice Festival in 1927.

A major international celebration

The annual Rice Festival celebration was interrupted by the Second World War from 1942 to 1945, but it came roaring back bigger and better. From being a mere promotional gimmick, the Rice Festival grew to become a major social event. In 1946, Crowley's Rice Festival went global when young ladies from other countries were invited to compete in the now International Rice Festival Queen Pageant. Consuls of 17 countries also attended the celebration.

It further expanded to include the naming of the farmer of the year, the Rice Bowl football game, concerts, rice cooking and eating contests, a livestock show, and other featured entertainment and activities that run from early morning until midnight.

By the 1970s, the International Rice Festival was on its way to becoming a larger-than-life attraction, with approximately 125,000 people attending in 1972. It became a self-sustaining organization in 1981 and is now regarded as Louisiana's oldest harvest festival.

The *Crowley-Post Signal*, the city's newspaper, estimated that more than 100,000 people came to the 74th International Rice Festival, bringing the total number of people that have attended the event since it began to over 7 million.

It takes a city

The International Rice Festival is Crowley's claim to fame. The city literally shuts down for a weekend to make way for the revelry—a massive undertaking that takes hundreds of people to make possible.

The Rice Festival Association has a general chairman and co-chairman as part of its executive branch, according to Glynn Mayard, chairman for this year's event. "Being the general chairman of the largest and oldest agricultural festival in the state of Louisiana is an awesome honor and privilege," Mr. Mayard said. "I rely on some key people to see that all our activities run smoothly."

To put together a festival, Mr. Mayard works closely with Jay Suire, the event's current co-chairman; Roxie Viator, the festival's coordinator; and members of the executive committee who help in making major decisions on the direction of the festival. Above all, Mr. Mayard praises the citizens of Crowley who volunteer their time and effort for the celebration.

"I am humbled to head a group of over 200 unpaid volunteers," he said. "Those volunteers have made the festival such a success year after year."

For Mr. Mayard, those people that show up year after year to work in their various committees are the unsung heroes that make the festival what it is today. "For some 75 years, they have been the heart and soul of our festival," he said.

INTERNATIONAL RICE FESTIVAL® (6)

The sights and sounds of the International Rice Festival have attracted more than 7 million visitors since it began 75 years ago.

A craze for maize

Maize gradually comes out of rice and wheat's shadows to offer its own set of benefits to farmers in Bangladesh

by **Paula Bianca Ferrer**

Unlike rice, which traditionally has been a staple food of many Bangladeshis, maize was mostly viewed as a minor crop until government initiatives and favorable market opportunities and conditions created a demand for it.

Before its independence in 1971, Bangladesh rarely cultivated maize, and, about 18 years ago, it did not have an established market. Thus, farmers were not interested in cultivating or in properly integrating maize with other traditional crops such as rice and wheat.

However, in the 1980s, the government bagan efforts to promote maize to local farmers to boost the country's food supply. By the 1990s, demonstration plots were set up in farmers' fields to increase awareness about the crop and expand its cultivation. Progress was slow, however, and, in the early 1990s, only a few farmers had adopted maize.

The lack of an existing market during that time was not the only dilemma. People also were not accustomed to mixing maize flour with wheat to make chapati, a round, flat unleavened bread and common household meal in Bangladesh. But, quite favorably, expansion of the poultry, fisheries, and livestock industries in the country brought with it previously unseen opportunities for maize.

A feed market

Initially, the demand for maize as feed was met by imports from Thailand, the United States, and India, among other countries. Soon, poultry farm owners turned to locally produced maize and the country imported only what it needed to fill the gap. As the industries grew, however, so did the demand and market for maize.

PROJECT STAFF members from all districts in Bangladesh observe an adaptive research trial on maize in a farmer's field in Comilla.

WAHIDUL AMIN

Because of the growing poultry market, the area planted with maize increased to about 220,000 hectares in 2008 from 179,000 hectares in 2007 and 137,000 hectares in 2006. The country's poultry industry provides a cheap source of protein and employs about 5 million people. Millions of households rely on this industry for their nutrition and for generating income.

In the last 2 decades, this industry has grown at about 20% per year. It is still expected to grow because, as the population continues to rise, so does its per capita consumption of chicken and eggs. This projected growth seems likely in the future given that the industry also does not seriously suffer from bird-flu outbreaks.

Aside from the poultry industry, the cattle and fish industries also have a demand for maize as feed. And, in some rural and urban areas, maize is mixed with wheat to make chapati. Moreover, maize has an extra value as farmers use its leaves and stems to feed their dairy cattle.

With bright market potential, the area planted with maize increased dramatically in the last few years. But, since these systems grew in significance only during the 2000s, concerns over their sustainability have emerged only recently.

Rice and maize have almost completely opposite requirements in terms of soil environment. Rice requires well-puddled clayey soil with high water-holding capacity. On the other hand, maize needs a loamy soil, which is well aerated and has good tilth. Working on the soil then becomes tricky for farmers who do not want to sacrifice rice but want to try maize so they can have an added market opportunity.

Other problems are the improper or low use of irrigation, imbalanced use of fertilizers, and the need for guided principles or technologies for sustainable management.

Sustainability is key

In 2008, the International Rice Research Institute (IRRI) started collaborating with the International Maize and Wheat Improvement Center (CIMMYT), and International Plant Nutrition Institute, as well as national partners such as the Bangladesh Agricultural Research Institute, Bangladesh Rice Research Institute, Bangladesh Academy of Rural Development, Bangladesh Rural Advancement Committee, and Rangpur-Dinajpur Rural Services on an initiative called the Sustainable Intensification of Rice-Maize Production Systems in Bangladesh.

Supported by the Australian Centre for International Agricultural Research (ACIAR), this 5-year project aims to enhance rice-maize systems in the districts of Comilla, Rajshahi, and Rangpur, where farmers' yields, in most cases, are low because of factors such as late planting of maize after rice in the rabi season, the use of recycled hybrid maize seeds, soil fertility depletion, excess moisture during germination and seedling establishment of rabi maize, waterlogging and crop damage due to heavy storms during the harvest of kharif-1 maize, water stress due to no or deficit irrigation, the low use of fertilizers other than nitrogen, and high production costs resulting in reduced input use. Hybrid maize is usually a high yielder but these factors result in actual yields that fall behind attainable yields.

Under this project, interventions such as screening and adapting maize varieties that are tolerant of excess moisture, enhancing nutrient management, testing conservation agriculture (CA) practices, and using resource-conserving technologies and then outscaling them to intended stakeholders (farmers, extension workers, and local researchers to name a few) have been started and will continue through the project's 2-year implementation and completion period.

From the project's inception in 2008, village farm surveys and group discussions with major stakeholders took place to help researchers gain useful insights into the rice-maize sector and its production systems. Household surveys also accompanied those first data-gathering activities, which would later help monitor and assess the project's impact.

At all project sites, researchers handle trials on nutrient management while both farmers and researchers jointly manage adaptive trials on CA practices. CA is founded on principles that aim to reduce mechanical soil disturbance as much as possible to maintain soil nutrients, prevent water losses, and avoid erosion. Increasingly, a lot of farmers, not just in Bangladesh but also in other parts of South Asia, have been adopting resource-efficient CA practices instead of their traditional farming ways.

SAIFUL ISLAM

TRAINING PARTICIPANTS discuss their experiences in using farm machines.

More than just research

Though the project initially focused on adaptive research in farmers' fields, it has now started emphasizing the dissemination of improved CA practices and site-specific nutrient management. Several farmers' field days and traveling seminars became the avenue for farmers, extension workers, and scientists to interact.

During a series of farmers' field days, farmers gathered around fields and shared their experiences, as well as discussed the benefits and constraints of farming using CA practices.

"Farmers improve on their practical knowledge of managing their production systems," said Jagadish Timsina, IRRI senior scientist and project head. "And, through interacting with scientists, farmers become more willing to try new practices as they begin to understand these systems more.

"These activities also provided ways in which project partners and stakeholders could help each other build their capacities further," Dr. Timsina added.

In another activity, farmers learned about using power tiller-operated seeders (PTOS) with different seed-metering devices and a bed former or planter. PTOS help farmers directly seed rice and maize while a bed former or planter assists farmers in making raised beds and planting crops on those beds.

The use of appropriate and affordable machinery was promoted in the project for farmers to rapidly establish rice, maize, and other crops under different CA-based tillage systems such as zero tillage, reduced and minimum tillage, and raised beds. These machines have also been tested for planting other crops such as mungbean in Rangpur and Rajshahi.

This project has been using and evaluating PTOS and the bed planter at its target sites according to Dr. Timsina. Agricultural engineers of national agricultural research institutions involved in the project have been helping to refine these machines continually so they could be used to maintain the precise depth of sowing as well as the desired plant population in different soils and climates in the country.

Through the project's capacity-building activities, more than 100 extension workers, farmers, and personnel from government and nongovernment organizations, among others, have been trained in operating and maintaining farm machinery such as PTOS and the bed planter.

By enhancing the capacity of major stakeholders in the management of rice-maize production systems, it is hoped that, in the not-too-distant future, intensive yet sustainable rice-maize systems will be possible, and will generate more year-round on-farm employment and income for Bangladesh's rural workforce.

Who eats the most rice?

by **Andrew Nelson**

On average, each person in the world consumes more than 50 kilograms of rice a year.[1] But, this average hides the massive variability in consumption patterns around the world. The map (Fig. 1) shows an unusual view of the world[2] in which each territory has been distorted based on the proportion of the world's rice that is consumed there. The coloring in the map represents the consumption per capita, so the map shows two key pieces of information that dictate rice consumption patterns.

Asia has a large share of the world's population and has high rates of consumption. China and India alone account for more than 50% of the world's rice consumption (Fig. 2). But, they are by no means the highest consumers per capita (see Table). Higher rates are found in much of South and Southeast Asia, West Africa, Madagascar, and Guyana. Several of these countries have per capita consumption rates over 100 kilograms per year, and Brunei tops the table at more than 20 kilograms per capita per month, compared with rates in Europe of less than 0.5 kilogram per month.

Although per capita consumption has always been high in Asia, it has more than doubled in the rest of the world over the last 50 years.[3] As we approach a world population of 7 billion, these geographic trends in rice consumption reveal new challenges and opportunities for rice production around the world.

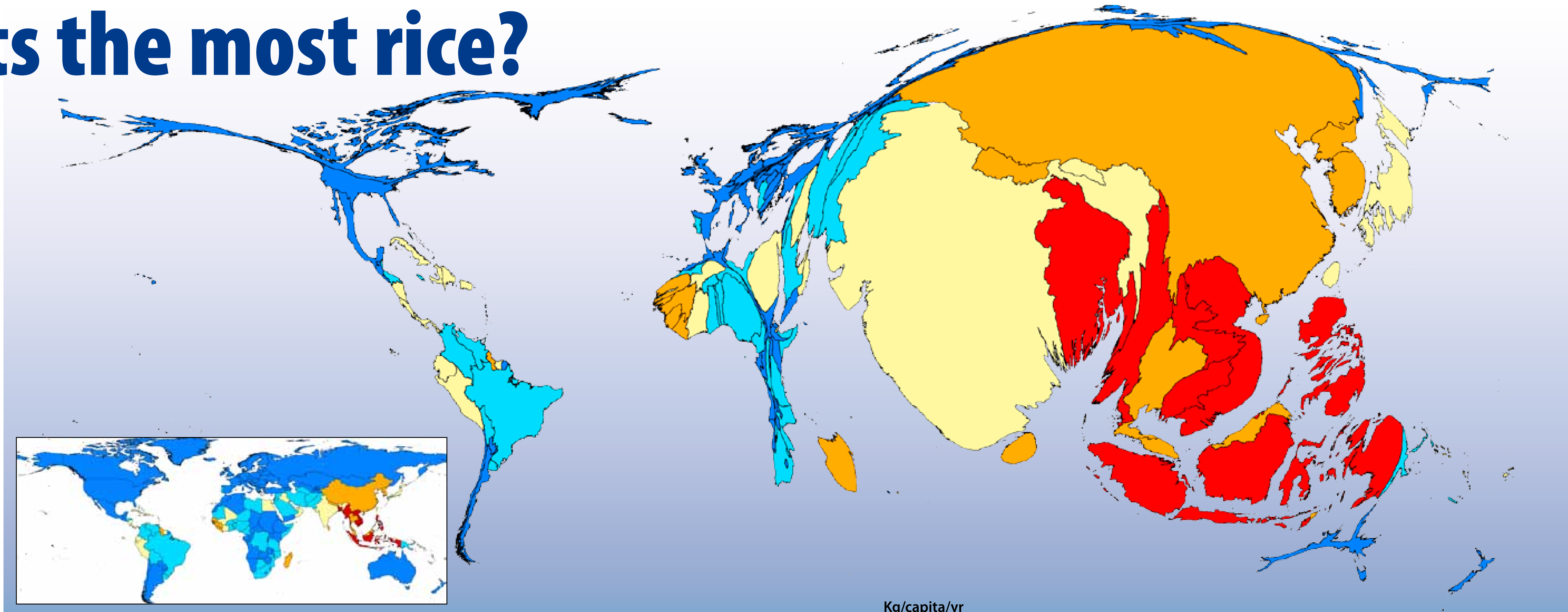


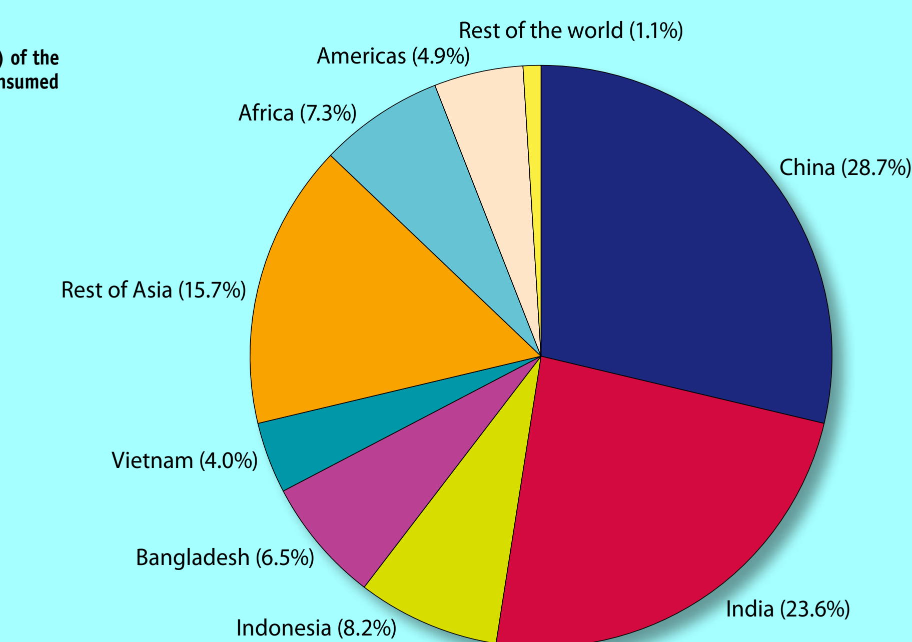
Fig. 1. Territory size represents the proportion of milled rice worldwide that is consumed in that territory. Color shows the per capita consumption of milled rice. Inset map shows a more traditional representation.

Top 20 per capita rice-consuming countries.

Brunei Darussalam	245	Sri Lanka	97
Vietnam	166	Guinea	95
Laos	163	Sierra Leone	92
Bangladesh	160	Guinea-Bissau	85
Myanmar	157	Guyana	81
Cambodia	152	Nepal	78
Philippines	129	Korea, DPR	77
Indonesia	125	China	77
Thailand	103	Malaysia	77
Madagascar	102	Korea, Republic of	76

Source: FAOSTAT - http://faostat.fao.org/site/609/DesktopDefault.aspx?PageID=609#ancor

Fig. 2. Proportion (%) of the world's milled rice consumed in each region.



[1] Food supply quantity data, FAOSTAT, http://snipurl.com/fao_stat.
[2] See www.worldmapper.org for more examples of cartograms in which territories are re-sized on each map according to the subject of interest.
[3] FAOSTAT (2010).

Hidden Treasure*

Interconnected solutions

In my travels around the globe, it amazes me how the human race is interconnected in so many ways and how kindness manifests itself in varying forms in every culture. Now that we are about to cross a momentous barrier in human history of having 7 billion human souls on our great planet, this interconnectedness will allow us to see that more mouths need to be fed.

It is always feared that, with the bloating global population, the human race would face many problems that would seem insurmountable. On a positive note, let us not forget that, with more people in the world, we also have more intellectual assets available to provide solutions. We are far from achieving an optimal world food system, yet we have done rather well in variety development as the success at IRRI has shown. However, many areas are still left for future advancement of production.

What strikes me is that, at its core, many areas need new varieties to increase yields, but, after this occurs, they must also have good postharvest techniques to protect both quantity and quality in fields. When we travel outside of cities to farming areas, a great divide exists in the systems of developed and developing countries. In the more developed countries, transportation systems are better—from good usable roads, to trucks using those roads, to good rail systems, to barge efficiency, and even ocean loading. Storage is another key issue. Many countries have yet to develop sufficient storage capacity, though you need roads or barges first for this to occur. Even the way rice is harvested can be a significant factor in getting more from a field.

The high prices seen in the major grain markets together with rice-related developments such as the recent Indonesian buying, India's rice stocks, and Thailand's return to the rice pledging scheme are all key issues that face the global rice market in the final quarter of 2011. This Thai rice pledging scheme will be implemented on 7 October 2011 and, with India on the brink of rejoining rice exports, price becomes an issue in itself, with Thailand instantly setting minimum prices at US$650, then maybe up to $750 per ton, while the Indian impact remains to be seen. With Thai rice exports, which are between one-fifth and one-third of global exports, you may see its power to negotiate a rise in price, enough to set the direction of the global industry. India, on the other hand, has about 60 million tons of rice and wheat stocks. Although these will get drawn down over the next few months to about 40 million tons, this amount remains huge, especially with harvests also peaking during this period. Then, the idea hit us that since the population is so large, the sheer size of the Indian markets could make consumption levels difficult to understand or predict.

India's stock-to-use ratio (16 million metric tons of stocks at year end) on wheat is about 18–19% while rice is around 24% (22 million metric tons of rice). The real question is, What do you do if you have the correct amount of stocks but insufficient storage? In this respect, India could still have a significant impact on the direction of prices on the back of such a massive release (2 million tons of rice and 1 million tons of wheat as approved by the government of India). By the time this issue comes out, more details will have become clear.

We have long stated the following fact about this market: the two worst things are prices that are too low and too high. In the 1990s and in the early 2000s, we experienced the effects of prices being too low, when investment in agriculture was minimal. Also, we experienced the opposite side in 2007-08, when prices reached the point where demand was even affected, when rice became unaffordable to the poor.

The solution seems to lie with price, and a price that would encourage investment in future production, while still remaining accessible to consumers (particularly the poor), hence providing a solution to some of the problems seen during recent years of high price volatility. Today, rice is relatively cheap compared with the price of major food commodities such as wheat, corn (maize), and soybeans. This suggests that either production should dip or that demand should shift to rice to rectify what appears to be an unbalanced market.

Jeremy Zwinger
Publisher

* The opinions expressed here are those of the author and do not necessarily reflect the views of the International Rice Research Institute.

Seven billion and counting:
What does this mean for global rice food security?

by **Samarendu Mohanty**

World population is projected to reach 7 billion by the end of this month (October 2011). Unfortunately, this historic moment arrives when the world has serious concern about future global food security. In the past 4 years, the world witnessed two food price spikes with greater price volatility that has affected millions of poor people. The factors underlying rising food prices are decelerating productivity growth coupled with greater occurrence of extreme weather, and the effects have been magnified by inward-looking domestic and trade policies of the major rice-growing countries. In addition, rice prices have been highly volatile in recent years, moving up and down by US$50 to $100 per ton in a matter of weeks in response to various fundamental and speculative factors. In the past few months alone, rice prices increased by more than $100 per ton primarily in anticipation of a possible reintroduction of the rice mortgage program in Thailand.

Rising food security concerns

Many Asian countries faced acute food shortages and struggled to feed their rapidly expanding population because of frequent famine and drought before the beginning of the Green Revolution in the late 1960s. Africa's health and nutrition status then was even slightly better than that of Asia. The life expectancy of most people in Asian countries was less than 50 years and infant mortality was unbelievably high, at 125–150 deaths per 1,000 births, compared with 100–300 deaths per 1,000 births in Africa.

The Green Revolution's first product—high-yielding semi-dwarf rice variety IR8—and the release of more than 1,000 additional modern varieties in the next half century changed the landscape of the entire Asian continent. During this period, global paddy rice production more than doubled from 312 million tons in 1970-71 to 677 million tons in 2010-11. Rice production growth has been so strong that it exceeded population growth during the entire Green Revolution era, which caused rice prices to decline by more than 70% (Fig. 1). Now, the health and nutrition status of the Asian population is much better than what it was before the Green Revolution.

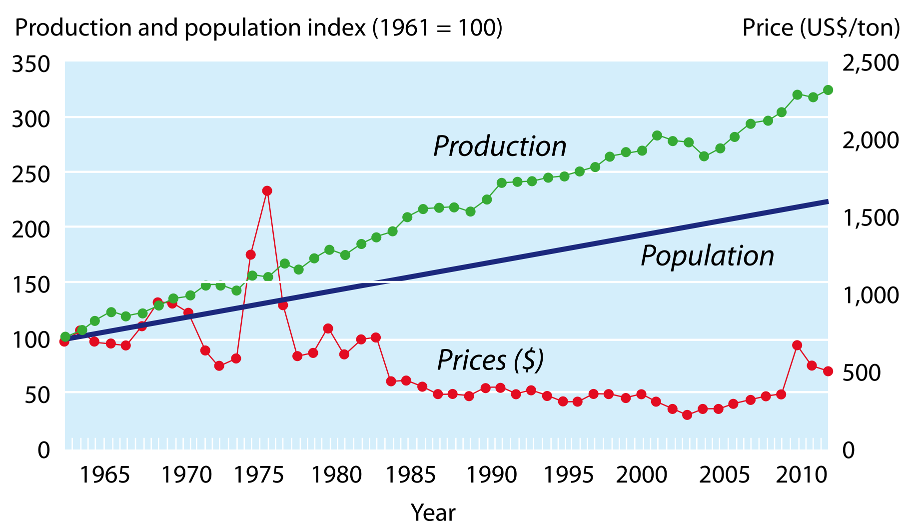


Fig. 1. Global rice production and population versus rice prices (1961-2010).
Data sources: FAO, United Nations, and World Bank.

Beyond the agricultural sector, lower rice prices during the Green Revolution era kept the wage rate low, contributing to faster overall growth of the Asian economy. The transformation of Asian countries from food deficit to self-sufficiency enabled them to use foreign exchange for infrastructure and other development activities rather than using it for food imports. Overall, the Green Revolution was a resounding success in expanding food production and improving the lives of hundreds of millions of poor people despite many criticisms on environmental and land degradation caused by the excessive use of fertilizers, pesticides, and irrigation water; groundwater pollution; and erosion of genetic diversity.

However, the annual yield growth rate of rice in the last decade has dropped to less than 1% compared with 2–3% during the Green Revolution period of 1967-90. With effects of the Green Revolution fading, the debate on rising hunger, malnutrition, and food insecurity is taking center stage once again. Two food price spikes in the past 4 years have shaken the foundation of global food security and concern has been raised as to whether the global food system can feed the world population, which is estimated to reach 9 billion in 2050.

Talks on food security now find their way onto the agenda of many global and regional forums such as G8, G20, the Asia Pacific Economic Conference (APEC), the Association of Southeast Asian Nations (ASEAN), and the South Asian Association of Regional Cooperation (SAARC).

Food security experts, policymakers, and other stakeholders call for another Green Revolution. However, everyone realizes that the approach adopted that led to the success of the first Green Revolution may not be applicable now. This time around, we need to think about 7 billion hungry mouths—twice the population the world had in the late 1960s that marked the beginning of the Green Revolution. During the first Green Revolution, many Asian countries aimed at achieving rice self-sufficiency by encouraging farmers to expand production through subsidized inputs and assured markets for their products. Farmers responded by adopting input-responsive high-yielding modern varieties and bringing additional land into crop production.

In the past 5 decades, nearly 25% of the production growth has come from area expansion, whereas 75% has come from yield growth. Area expansion, which includes both physical area and greater cropping intensity on the same piece of land, was made possible because of better infrastructure and the development of short-duration varieties.

To continue this trend is not a viable option for most Asian rice-growing countries, where additional land is no longer available and pressure on the existing rice land from urbanization and other nonagricultural uses is growing rapidly. This is particularly true for China, India, Indonesia, Thailand, the Philippines, and Bangladesh, which account for nearly 70% of global rice production and consumption. For example, China's rice area has declined by more than 5 million hectares (15%) in the past 3 decades and the downtrend may continue in the future. Although a similar downtrend has not been evident in other rice-growing countries in the region because of government interventions, it is hard to foresee how governments can continue with such interventions in the face of rising costs, water shortages, and growing pressure from competing sectors.

The few exceptions could be countries such as Cambodia and Myanmar, which were left out of the Green Revolution for varying reasons but they could be stimulated to expand rice production by developing infrastructure and providing better market linkages.

Toward a stable future

The future of global rice food security depends on the strategies of the major rice-growing countries in Asia. If these rice-growing countries decide to pursue self-sufficiency, opportunity will be less for any structural transformation of the global rice market, keeping it volatile with frequent price spikes in years of tight supply. However, if these countries send a clear signal to the world of their long-term food security strategy and their intention to depend on the global rice market for a certain percentage of their domestic consumption, a massive change in the global rice industry could be on the horizon. Their intention should be reflected in the form of fewer trade restrictions such as an export ban, and minimum export or import prices, and allowing private traders to take charge of exports and imports rather than state trading agencies. This will allow investment to flow into countries endowed with land and water to take advantage of the growing rice market.

The change in the global soybean market 3 decades ago may provide a clue as to what could happen in the rice market. In the soybean market, the United States used to be a big guy on the block. The country represented around 80% of world production and 95% of total exports during the 1960s and 1970s. The ban on soybean exports imposed by the U.S. in the early 1970s altered the entire landscape of soybean production and trade when other countries started looking for alternative suppliers.

China, Japan, and the European Union invested heavily in developing infrastructure in South America. And, in 2 decades, two South American neighbors, Argentina and Brazil, emerged as formidable competitors to the U.S. in the world soybean market. Now, these countries account for around half of the global soybean trade. The emergence of many dependable suppliers also convinced many countries, including China, Japan, the European Union countries, Taiwan, South Korea, and others, to liberalize their oilseed sector. For example, China has imported 52 million tons in 2010-11. This is 79% of the total domestic consumption, which is in stark contrast to its negligible imports until 1990.

Similar to the soybean transformation, potential exists for expansion of rice production in sub-Saharan Africa (SSA) and Latin America. Many SSA countries have land and water but they could not realize their full potential because of political instability, poor infrastructure, and inefficient supply chains. These constraints have kept paddy yields in many SSA countries much lower than in their Asian counterparts (Fig. 2). At the same time, many Latin American countries such as Brazil, Argentina, Uruguay, and Paraguay can expand rice production as long as a market is available for their rice and it is more profitable than competing crops such as soybean, cotton, and wheat.

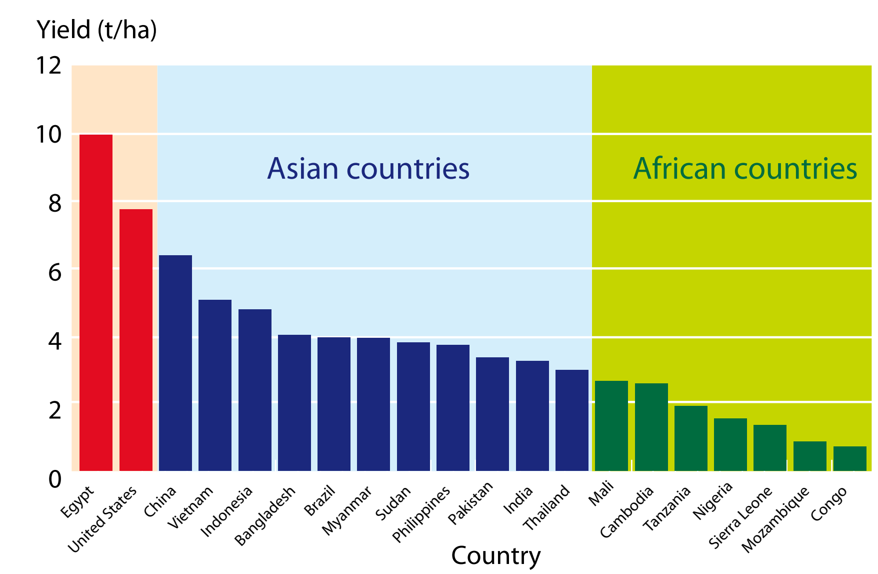


Fig. 2. Average paddy yields (2005–06-2009–10).
Data source: FAOSTAT (2011).

Clash of the Titans: Global population versus Food production

by Shenggen Fan

According to recent estimates by the United Nations, the world population will reach 7 billion in October 2011, and this number could rise to 9 billion by 2050 (see *Monitoring an inconvenient divergence* on page 4). Nearly all of the growth—97%—is projected to come from developing countries, especially in Africa and Asia. Demand for rice is now growing faster than rice production. If nothing is done to ensure consistent and adequate rice supplies, the price of rice will continue to rise.

Rice supply and population growth

Asia represents about 90% of global rice production and consumption. It is also home to many millions of poor and hungry people who depend on rice for most of their calorie requirements. Many of them are poor farmers who not only consume rice but also grow it on small plots of less than 2 hectares. In fact, the International Rice Research Institute (IRRI) reports that nearly two-thirds of the world's poor live in rice-producing areas in Asia. Current trends in population growth are expected to push this share even higher. Africa also has significant rice consumption and a large number of poor people.

Global rice demand is expected to rise in the coming decades, albeit in different amounts across regions. These changes in demand are mainly due to population growth, rising incomes, urbanization, and changing food preferences. At the global level, per capita rice consumption may become flat, but will increase in Africa, the Middle East, and the Americas while it will decline in some Asian countries that are experiencing diet shifts due to higher incomes and urbanization. Rice production, on the other hand, has slowed down, thus tightening rice supplies. Production growth has lagged for several reasons, including stagnant or declining crop yields, underinvestment in agricultural research and development, increasing land and water constraints for agriculture, increased input costs, and increased labor costs due to urbanization

Global rice demand is expected to rise in the coming decades, albeit in different amounts across regions, mainly due to population growth, rising incomes, urbanization, and changing food preferences

and industrialization. In the coming years, climate change is expected to put additional pressure on rice production systems, further tightening rice supplies.

The surges in food prices in 2007-08 and 2010-11 and the rapid depletion of global food stocks reveal that the world is increasingly vulnerable to food shortages or crises. As the populations of rice-producing and -consuming regions expand rapidly, concrete actions must be taken to boost production and secure rice supplies, especially for the millions of poor people who reside in these regions.

What must be done?

Asia's experience during the Green Revolution—when the introduction of improved rice varieties led to higher rice yields and output—shows that technology is the key to spurring rapid growth in rice production. In addition to bridging the gap between demand and supply, rice productivity growth will also have large poverty reduction impacts as many rice producers are poor small farmers that depend on rice production for their livelihoods. New technologies, including postharvest technologies, must be rolled out continually on a large scale to achieve these impacts.

Recent strides in rice technology development and delivery are promising. Rice hybrids that are high-yielding, resistant to pests and diseases, and tolerant of environmental stresses are being developed and are increasingly available to farmers. Around 20 million hectares of hybrid rice are now grown globally, with the largest share, 85%, grown in China, according to IRRI. Biofortified rice, enriched with micronutrients such as vitamin A and zinc, has also been developed and has large potential to significantly improve the nutrition of poor consumers. To ensure environmental sustainability, technologies for the mitigation of greenhouse gas emissions in rice production should be promoted since rice production is one of the largest agricultural sources of methane emissions.

Although technology is a must to meet the increasing demand for rice, technology alone is not enough. Policy and market incentives are also needed to promote production growth, especially among small farmers. Investments are needed to improve small farmers' access to high-yielding seeds and fertilizer, as well as to encourage them to diversify into high-value commodities or nonfarm activities. To help them cope with risks that stem from weather shocks, innovative risk management mechanisms, such as weather-based index insurance, must be strongly promoted. Access to financial services is also crucial for smallholder farmers, and emerging initiatives such as community banking have proved helpful.

To enable small farmers to participate profitably in global rice supply chains, they need to be linked to high-value markets. Institutional innovations such as farmer associations and contract farming schemes can help reduce market transaction costs and increase access to information. Investments in rural infrastructure will also be crucial to enhance the efficiency and profitability of the rice supply chain. In the trade arena, national governments must refrain from imposing export bans that tighten food markets and dampen production incentives. Strategic rice reserves such as the ASEAN Plus Three Emergency Rice Reserve are critical to ensure that the poor have access to adequate food, especially during emergencies. To successfully meet the food needs of a rapidly growing population, the implementation of these actions is imperative.

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Nutrition Improvement Program

NutriRice™ – A breakthrough in rice fortification

Rice fortification presents numerous technical problems. Micronutrients cannot simply be added to the kernels, because they do not stay where they are needed. The traditional soaking and rinsing of rice with water prior to cooking removes most of the added nutrients. In the past, addition of reconstituted, fortified rice kernels to normal rice proved unsatisfactory, because consumers saw the added kernels as a «contamination», and removed them.

To overcome these difficulties, NutriRice uses a hot extrusion method with encapsulated vitamins and minerals. The fortified kernels look, taste and behave exactly like normal rice; the micronutrients embedded in the kernel are efficiently protected from external influences during washing and cooking. The process uses low-cost broken rice as raw material, and kernels can be made to customers' specific requirements of shape, color and micronutrient content.

To guarantee an appropriate intake of the vitamins and minerals needed for good health, NutriRice fortified kernels are mixed with natural rice in a ratio of 1:99 or 2:99. This results in a product of excellent physical stability, in which the added micronutrients are retained in adequate amounts during storage, washing and cooking. Compared with rice fortified by any other method, NutriRice is a better source of essential micronutrients.

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