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Rice Today

International Rice Research Institute

April-June 2012, Vol. 11, No. 2

Depositing seeds in community banks

Little machines making big waves in Africa

How much rice does the world waste?

Thailand and the global rice market

African deities and rice

ISSN 1655-5422

contents

RiceToday Vol. 11, No. 2

About the cover. Community seed banks help conserve genetic diversity and save farmers from months of hunger.

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

TRT, for 22 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.

The Rice Trader Inc.
9287 Midway, Suite 2B, Durham, CA 95938-9778
Web: www.thericetrader.com

International Rice Research Institute
DAPO Box 7777, Metro Manila, Philippines
Web (IRRI): www.irri.org; www.irri.org/ricetoday
Web (Library): http://ricelib.irri.cgiar.org
Web (Rice Knowledge Bank): www.knowledgebank.irri.org

Rice Today editorial
telephone: (+63-2) 580-5600 or (+63-2) 844-3351 to 53, ext 2725; fax: (+63-2) 580-5699 or (+63-2) 845-0606; email: l.reyes@irri.org, aileen.macalintal@thericetrader.com

cover **Juan Lazaro IV**

publisher **Jeremy Zwinger**
associate publisher **Sophie Clayton**
managing editor **V. Subramanian**
editors **Lanie Reyes, Aileen Macalintal**
contributing writers **Gene Hettel, Samarendu Mohanty, Andrew Nelson, Alaric Santiaguel, Lovely Merlicel Quipot, Ma. Lizbeth Baroña, Paula Bianca Ferrer, Trina Leah Mendoza**
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designer and production supervisor **Grant Leceta**
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circulation **Lourdes Columbres**
Web masters **Alaric Francis Santiaguel, Jerry Laviña**
printer **DHL Global Mail (Singapore) Pte. Ltd.**

Partners in growth

Rice Today is starting its 11th year of publishing compelling stories on rice. In what direction will the magazine move in the next decade?

So much has changed since its first publication in 2002, when *Rice Today* began by featuring research results mostly from the International Rice Research Institute and usually emphasizing Asia. In the last 3 years, it has slowly evolved toward being a global magazine on rice. Its stories come from IRRI and from institutions such as the Africa Rice Center and International Center for Tropical Agriculture, agricultural universities, and other organizations from both the public and private sector around the world. Now, more and more updates and information come from not only Asia but also Africa, Latin America, and North America.

To map our way toward growth and make *Rice Today* truly global, one of our plans is to expand our network of partners who can also guide us in the right direction. Indeed, when more people work together, getting to a destination can be more effective. Hence, the formation of the magazine's editorial board. In May 2012, the board holds its inaugural meeting in conjunction with the Americas Rice Conference (in Miami) hosted by the magazine's publisher, The Rice Trader.

The board will assist the magazine in achieving its goals: to highlight the impact of rice research in reducing poverty, improving global food security, and tackling environmental problems; to focus on rice production in underdeveloped and developing countries in Asia, South America, and Africa; and to share the latest updates and advances in rice research and its development, extension, and adoption across the entire rice industry—farmers, farm suppliers, extension providers from the public and private sector, postharvest processors, traders, and consumers.

Since the editorial board will serve as a think tank for story ideas for the magazine that best capture the world of rice in ways that will be of interest to readers, the board includes some outstanding representatives from different areas of rice science and industry, and rice-producing regions. We would like to thank all the members of the board in anticipation of their great ideas and contributions that we hope will build on the foundation of *Rice Today*. (See members of the board on the next page.)

This move is timely and fitting as *Rice Today* will also serve as the flagship publication of the Global Rice Science Partnership (GRiSP), a strategic work plan for global rice research. With this role, we are positive that *Rice Today* will be able to contribute more to sharing the ideas needed that will benefit all those who have a stake in rice science and development. The publication does this by publishing compelling stories and learned opinion pieces, some of which can inspire growth and progress in the world of rice.

In this issue, our cover story tackles how farmers in southern Philippines learned to increase their supply of good-quality, culturally important seeds through community seed banks. Another success story is that of a mechanical thresher that has become popular in Africa because of its capacity to eradicate back-breaking manual labor on farms. For a more comprehensive take on rice-farming mechanization, we examine the question: What does it take to introduce farm machines in a sustainable way?

On rice consumption, we investigate how much rice the world wastes—in the end, we encourage responsible consumption to help overcome food scarcity. We analyze the perennial problems of rice supply and demand through USDA's eight economic factors that will dominate global agriculture in the next 10 years. In the same economic thread, a senior analyst from Nanyang Technological University in Singapore discusses the move toward rice self-sufficiency in Indonesia and the Philippines (*Grain of Truth*). Finally, our *Rice Facts* column scrutinizes Thailand's rice pledging scheme and its impact on world rice trade.

On the lighter, but no less significant, side, we have our mainstay *What's cooking?* (Panfried glutinous rice) and an article on culture called *Rice of deities*, featuring a function of rice other than consumption—rice as an offering to African gods and goddesses.

Finally, to set an example on how partnerships can move us closer to achievements, we highlight Japan (which has supported rice research for decades); and also feature partnerships that aim to raise upland farmers' incomes.

With new partners from around the world, the next decade of publishing rice stories—in a time of increasing global challenges—may be less daunting.

Lanie Reyes and Aileen Macalintal
Rice Today editors

RiceToday

The RiceToday Editorial Board

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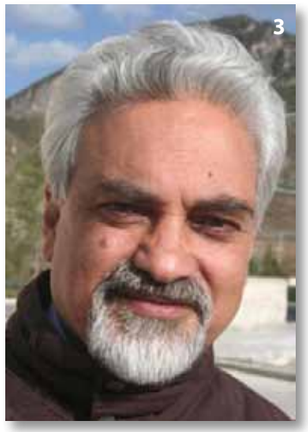
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7


6


5

Rice records big impact in Southeast Asia

Rice research has a major documented impact in Southeast (SE) Asia compared with other agricultural research investments, according to a report published in *Agricultural Systems*.

It showed that around 90% of total documented benefits of agricultural research over the last 5 decades in SE Asia were due to rice research.

Most of the US$33.5 billion of rice research benefits were due to the development and release of new and improved rice varieties. This supports another report from 2011 by the Australian Centre for International Agricultural Research that showed SE Asian rice farmers harvesting an extra $1.46 billion worth of rice a year as a result of rice breeding.

IRRI

RESEARCH EFFORTS to develop new rice varieties for SE Asian farmers are documented as having a big impact.

Ninety percent of total documented benefits of agricultural research over the last 5 decades in SE Asia were due to rice research.

Associate Professor Mywish Maredia at Michigan State University, the lead author of the report, said, "The analysis offers compelling evidence that past investments in agricultural research in the region have been productive. The large share of rice research in total documented impacts shows that there is considerably more certainty about the ability of rice research, particularly genetic improvement, to generate impact in SE Asia than is the case for other research."

The Asian Development Bank (ADB) supported the research to identify the key agricultural R&D activities that could most effectively help deliver food security in SE Asia.

"Continued research on rice is an imperative agenda for Asian agricultural R&D as rice is and will be a major staple food in Asia and the Pacific region," said Dr. Lourdes S. Adriano from ADB.

Report co-author David Raitzer from IRRI added, "In relation to the impact documented, rice research across both national and international agricultural research systems in SE Asia is underinvested."

Benefits from other areas of research such as improved crop management strategies that improve water or fertilizer use are harder to quantify but are likely to be delivering additional impacts to both productivity and the environment. Almost certainly, other impacts beyond rice research remain undocumented. However, in the absence of systematic assessment, their magnitude is uncertain compared with rice research.

Raitzer is now leading an interdisciplinary team of scientists at IRRI to assess the impact of different areas of rice research on poor communities across Asia.

These findings will then be used to help target rice research investment to help ensure it has the biggest impact possible to help lift Asian rice farmers and consumers out of poverty.

See YouTube video on the impact of rice research at http://youtu.be/FUBeeYlRhTo

"Continued research on rice is an imperative agenda for Asian agricultural research and development as rice is and will be a major staple food in Asia and the Pacific region."

-Dr. Lourdes S. Adriano, ADB

Developing countries continue to embrace GM crops

Developing countries are adopting genetically modified (GM) crops faster than ever before says the latest report on the *Global Status of Commercialized Biotech/GM crops: 2011* from the International Service for the Acquisition of Agri-Biotech Applications.

The report states that developing countries grew about 50% of global biotech crops in 2011 and are expected to exceed the area in industrial countries in 2012. In 2011, 7 million farmers each in India and China grew Bt cotton; the gain in productivity from Bt cotton in India alone is estimated at US$2.5 billion.

The growth rate for biotech crops in 2011 was twice as fast and twice as large in developing countries, at 11% or 8.2 million hectares, versus 5% or 3.8 million hectares in industrial countries.

For some crops in industrial countries, GM crops already account for more than 90% of the crops planted, such as maize and cotton in the U.S.

In China, the government has reconfirmed the national importance of biotech crops to be developed under strict biosafety standards. Bt rice (with built-in insect resistance) was biosafety-approved in 2009 in China and is now undergoing standard field testing for variety releases.

As reported in *Farm Chemicals International*, author Clive James said that when GM rice comes on board in 2013 or 2014, the concentration of growth in developing countries will be even more obvious than it is now.

"I've had the privilege of talking to farmers in 150 countries around the world, and one feature about farmers is that they are risk-averse," says James. "They are used to dealing with uncertainty, and very rarely can you fool a farmer.

"If the technology doesn't deliver the benefits, farmers are the first to reject it," he concluded.

Sources: www.isaaa.org and www.farmchemicalsinternational.com

Bt rice: no postharvest impact on arthropods

New research from China shows that residues from Bt rice do not have adverse postharvest impacts on arthropods such as insects and spiders, which are natural predators of several rice pests.

Bt rice was genetically modified to resist stem borers—a major pest of rice.

According to an item published in *Transgenic Research*, harvested rice fields left unplanted or fallow provide a critical overwintering habitat for arthropods in Chinese rice ecosystems, particularly in the southern part of the country.

Two independent field trials conducted in Chongqing, China, from 2006 to 2008 investigated the effects of Bt rice residues on nontarget arthropod communities.

IRRI

SPIDER COMMUNITIES are not adversely affected in Bt rice fields after harvest.

In each trial, pitfall traps were used to sample arthropods in field plots planted with one non-Bt rice and two types of Bt rice. More than 52,000 insects and spiders from 93 families were captured in the trials.

The report states: "In general, there were no significant differences among non-Bt and Bt rice plots in all arthropod community-specific parameters for both trials, suggesting no adverse impact of the Bt rice plant residues on the aboveground nontarget arthropod communities during the postharvest season."

This study provides more evidence that Bt rice is safe for nontarget arthropod communities in Chinese rice ecosystems.

Source: www.springerlink.com

Queen Elizabeth II recognizes former IRRI scientists

Dr. John Sheehy, IRRI's former leader of the C_4 Rice Project, and Dr. Michael Jackson, former head of the International Rice Genebank and director for program planning and communications, were on the 2012 Honors List of Queen Elizabeth II. They received their medals as Officers of the Order of the British Empire (OBE) in a formal investiture held at Buckingham Palace in February 2012.

DR. SHEEHY (*above*) shows his OBE medal at Buckingham Palace. Mike Jackson (*left*) holds his OBE medal. The medal is a symbol of British orders of chivalry.

Rice next to get salt-tolerance gene?

A team of Australian scientists from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and University of Adelaide have successfully introduced a salt-tolerance gene into durum wheat, used for pasta and couscous, which could be planted by farmers in 5 years.

Dr. Matthew Gilliham, from the university's Waite Research Institute, said the gene could also be used in other varieties of wheat and other crops such as barley, oats, and rice.

The team used nongenetically modified breeding techniques to incorporate the gene.

Source: www.news.com.au

China's Father of hybrid rice wins Mahathir Science Award

Popularly known as the father of hybrid rice, Professor Yuan Long Ping won the Mahathir Science Award 2011.

The Award is bestowed on any scientist, institution, or organization worldwide in recognition of contributions and innovations toward solving problems of the tropics through science and technology.

Initiated by the Academy of Science Malaysia in 2004, the Award is now managed by the Mahathir Science Award Foundation.

Source www.msa-foundation.org.

Nutrient advice now on smartphones

Since its debut in the Philippines in 2011, Nutrient Manager for Rice Mobile—designed to give fertilizer guidelines to rice farmers via their mobile phones—is now available via smartphones with Android operating systems.

By using NMRiceApp on their smartphones, extension officers can visit farmers, interview them, and store information on their smartphones. Once a smartphone is connected to the Internet, the extension officer can process the fertilizer recommendation for the farmers and send it to them via text messages.

EDSEL MOSCOSO

SMARTPHONES are a new way to deliver nutrient management advice to extension officers in the Philippines.

U.S. rice farmers fund research

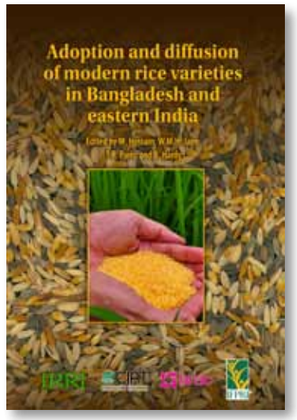
Rice farmers in the U.S. state of Louisiana have agreed to continue paying 5 cents for every 100 pounds (about 45 kg) of rice produced for research.

"I can assure farmers that they are getting their money's worth," said Steve Linscombe, Louisiana State University AgCenter director. "A continuation of these checkoff funds means that research can continue to develop new varieties and to improve rice farming practices."

Source: http://deltafarmpress.com

Books

Adoption and diffusion of modern rice varieties in Bangladesh and eastern India



Edited by M. Hossain, W.M.H. Jaim, T.R. Paris, and B. Hardy

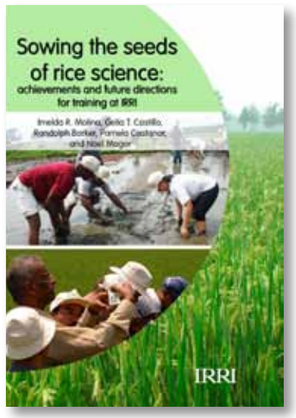
This book tackles the diversity, spatial distribution, and adoption of modern rice varieties in Bangladesh and three neighboring states of India (West Bengal, Orissa, and Jharkhand). It includes the nutritional implications of consumer preferences as well as milling and cooking practices in these areas, plus an assessment of the potential of biofortification in addressing the problem of micronutrient malnutrition in rice-based cropping systems in South and Southeast Asia. This publication is a result of a research study pioneered by the International Rice Research Institute (IRRI) and the International Food Policy Research Institute (IFPRI) under the HarvestPlus project of the International Center for Tropical Agriculture (CIAT).

Handbook on rice policy for Asia

By Annette Tobias, Imelda Molina, Harold Glenn Valera, Khondoker Abdul Mottaleb, and Samarendu Mohanty

The rice sector has been subject to a number of policy interventions because of its strategic and political importance. This publication aims to explain the current policy structure in the major rice-producing and -consuming countries in Asia.

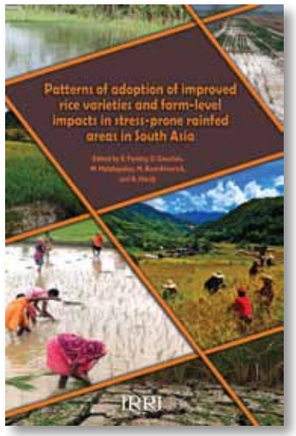
Sowing the seeds of rice science: achievements and future directions for training at IRRI



By Imelda R. Molina, Gelia T. Castillo, Randolph Barker, Pamela Castanar, and Noel Magor

This publication gives an overview of training at IRRI and its impact on rice scientists and extension workers across Asia in almost 50 years. This book includes a database of IRRI training programs and participants from 1962 to 2010 and IRRI's future plans for training and capacity strengthening of national agricultural research and extension systems.

Patterns of adoption of improved rice varieties and farm-level impacts in stress-prone rainfed areas in South Asia



Edited by S. Pandey, D. Gauchan, M. Malabayabas, M. Bool-Emerick, and B. Hardy

This publication presents the patterns of adoption of improved rice varieties and their impact on farming households in the stress-prone rice-growing areas of Bangladesh, India, and Nepal.

These books will be online soon at http://books.irri.org.

SELECTED TRAINING COURSES AT IRRI

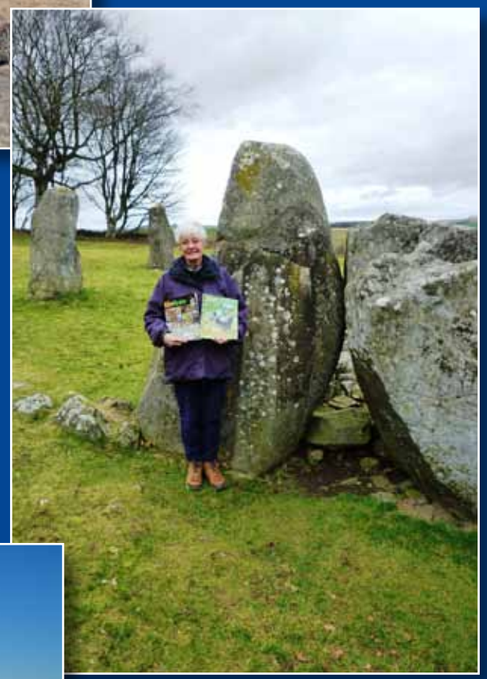
Course title	Date	Venue	Target participants
Project management	14-18 May	Dhaka, Bangladesh	Early career scientists, postdoctoral fellows, or senior managers
Projects in controlled environments 2 (PRINCE2)	29 May-1 June	IRRI, Philippines	Global Rice Science Partnership (GRiSP) program leaders
Advanced indica transformation course	4-9 June	IRRI, Philippines	Researchers working on transformation studies
Personal skills for professional development	11-15 June	IRRI, Philippines	Scientists, postdoctoral fellows, or senior managers
Rice breeding course	1-16 August	IRRI, Philippines	Breeders, agronomists, or research managers

For the complete list and information about the 2012 IRRI Training Courses, visit http://snipurl.com/training_courses_2012.

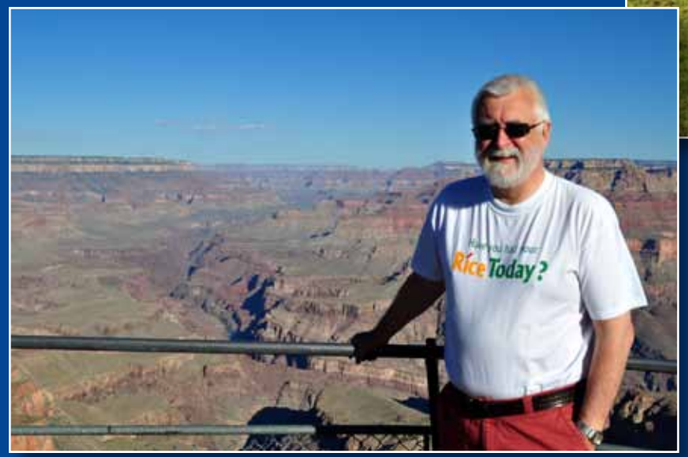
For inquiries, email IRRITraining@cgiar.org, call (63-2) 580-5600 ext. 2538/2824/ 2437/2324, or send a fax to (63-2) 580-5699, 891-1292, 845-0606.

RiceToday around the world

SCIENCE LOVE, once upon a time in Mexico. Husband and wife Jun and Teri Ulat—both IRRI associate scientists—look set for an archaeological adventure with *Rice Today* issues in hand. The photo was taken at the Pirámides in Teotihuacán, Mexico, a UNESCO World Heritage site, where pyramidal structures were said to have existed since 100 BC.



STONES AND MILESTONE. Dr. Jill Lenné, an IRRI Board of Trustees member, holds two issues of *Rice Today*—one of which has the cover of covers that celebrate a milestone for the magazine: 10th year anniversary. This photo was taken at the Loanhead of Daviot recumbent stone circle in Aberdeenshire, Scotland. These stone circles were constructed over 4,000 years ago by farming communities, and served as lunar calendars, showing the passing seasons by the way the parts of the circle framed the moon.



GRAND ROYALTY. Dr. Michael Jackson, former IRRI scientist who was recently awarded the royal Order of the British Empire, stands before the Grand Canyon, Arizona, USA, wearing his *Rice Today* shirt.

South Sulawesi's homegrown champion

by **Trina Leah Mendoza**

RICE FARMERS in Bone, Indonesia, use horses to haul the day's harvest back home.

Calm and smiling, he spoke with authority, and the interviewer from Televisi Republik Indonesia (TVRI) kept probing him for more. He talked about alternate wetting and drying, a water-saving practice, and the Nutrient Manager, both technologies developed by the Irrigated Rice Research Consortium (IRRC) at the International Rice Resarch Institute. The next morning, he was interviewed again by TVRI, this time, about maize, at the Assessment Institute for Agricultural Technology (AIAT) office of South Sulawesi in the town of Maros. Professor Djafar Baco is the go-to-guy when it comes to maize and rice production in South Sulawesi.

Prof. Baco was born and raised in Bone District, South Sulawesi, in a small village called Dusun Salokaraja, where only eight houses used to

PROF. DJAFAR Baco talked about IRRC technologies such as alternate wetting and drying and site-specific nutrient management during a TV appearance at a local TV station in Makassar in January.

WHEN HE gets to see the farmers and their rice fields in South Sulawesi, Prof. Baco rarely visits without his wife, Nuraida.

stand. His great grandparents were among the original settlers of Dusun, although many advised them not to live there because of stories of ghosts and thieves. Nevertheless, it was here where he had his most cherished experiences.

At the age of 4, young Djafar's task was to tend their carabao, his parents being rice farmers. He remembers vividly that their carabao used to eat the rice crop of their neighbor, and his father had to pay them for their losses. His father did not scold or punish him, but this experience taught Djafar the importance of being responsible, which he carries with him to this day.

Before graduating from high school, he got interested in a project on sugarcane, and wanted to pursue this field in a university in Java, Indonesia. However, moving to Java would be expensive and far from home, so he opted to study at the University of Hasanuddin in Makassar. An entomologist by training, Prof. Baco finally achieved his dream of becoming a teacher like his uncle, when he taught ecological entomology at the University of Hasanuddin in Makassar City for 5 years.

He did research from 1975 to 1995 at the Research Institute for Food Crops, focusing on rice and maize. In 1996-2001, Prof. Baco headed the National Research Institute for Maize in Maros.

THE WOMEN in Bone, South Sulawesi, proudly carry the season's bountiful rice harvest in their village.

MADONNA CASIMERO (5)

It was when he became head of the Assessment Institute for Agricultural Technology in South Sulawesi from 2001 to 2004 that he started working with IRRC coordinator Grant Singleton on a project on rodent management funded by the Australian Centre for International Agricultural Research (ACIAR).

Partnership with the IRRC strengthened in 2008, in an ACIAR-funded project that aimed to improve rice productivity in South and Southeast Sulawesi (see *RIPPLE* May-August 2011). His career highlights include the "many good experiences from the project."

"The farmers are now solving their problems in the field," he says. He cites their problem with the rice bug. "Farmers used to spray insecticide that smelled very bad. Then, they tried other foul-smelling bait—chicken manure, fermented fish and shrimp, and golden apple snails—to attract rice bugs. A week later, the farmers found out that rice bugs were more attracted to the snails. This is how they check the rice bugs in the fields now," he shares.

Although he officially retired from AIAT in 2004, Prof. Baco's schedule remains as busy as ever. Future TV appearances are inevitable. His wife, Nuraida, often keeps him company during his travels to farmers' fields and overseas. In the January planning meeting for 2012 activities with the IRRC, Prof. Baco lightheartedly said, "Don't worry; I will work with you until I die."

His efforts with the project have truly been valuable and have contributed to the farmers' increase in income by more than US$207, on average, per season per hectare. As the IRRC enters a new chapter in 2013, the Consortium looks forward to more years of working with Prof. Djafar Baco, South Sulawesi's homegrown champion.

HUSBAND AND WIFE help each other during harvest time in Konawe, South Sulawesi.

Excerpted from the Jan-April 2012 issue of RIPPLE, the newsletter of the Irrigated Rice Research Consortium. http://snipurl.com/ripple_indonesia

Bankseeds

by **Lanie C. Reyes**

Farmers have more access to good-quality seeds through community seed banks

In Arakan Valley, the upland "rice belt" of North Cotabato, Philippines, farmers hold dear a rice variety—Dinorado, a native upland rice characterized by its pinkish grain, sweet aroma, and good eating quality. For the Arakeños, Dinorado has been part of their community as far as they can remember. Long ago, the Arakan Valley was home to exotic Dinorado rice. So much so that Dinorado has become part of their pride and social identity.

Dinorado is a "special" rice that is sought for weddings, birthdays, and fiestas, among other occasions, and it is a status symbol in the country. Its price is 50% higher than ordinary rice. Unfortunately, the quality of Arakan Dinorado diminished as the genetic purity of its seed stocks declined.[1]

To preserve the purity of the seeds, farmers must know how to manage the health of their seeds—and this lack in management was found in the farm communities in an initial needs assessment of the Consortium for Unfavorable Rice Environments (CURE) of the International Rice Research Institute (IRRI).

Also, most of these farmers lack access to higher-yielding modern varieties. Traditional varieties tend to

have a lower yield (an average of 1.6 tons per hectare). Thus, 4–6 months of hunger is a common experience among farmers who cultivate traditional varieties. During these months of hunger, farmers and their family sometimes eat the seeds set aside for the next cropping season.

Another problem is that upland rice farming, which is mostly rainfed, is at the mercy of the weather. "For this same reason, seed producers do not usually lend seeds to upland farmers; even local moneylenders are less likely to invest in farming that is deemed high risk," related Dr. Rosa Fe Hondrade, a social scientist at the University of Southern Mindanao (USM).

These are some of the challenges that CURE aimed to tackle in Arakan. In a team effort, the CURE scientists at IRRI joined forces with USM, the Philippine Rice Research Institute, the Municipal Agricultural Office of Arakan, and the Department of Agriculture. They call themselves the "Arakan Valley team."

Seeds of survival

The Arakan Valley team understands the value of seeds to farmers. Farmers depend on viable seeds for the survival of their households; when seeds are scarce, so is food security. To avoid this problem, the team set its sights on improving seed health and quality management practices of the farmers and making modern varieties along with other traditional varieties available to them.

So, they mobilized a group of farmers who were willing to be trained on how to properly produce good-quality seeds and to know about modern rice varieties suitable in their area. This group of farmers evolved into a local network called the "community seed bank."

Benefits to the farmers

Through the community seed bank, "We learned how to produce quality seeds such as getting rid of unwanted types of rice from our fields, as well as selecting, drying, and storing seeds, and other seed health practices," said Nestor Nombreda, a 54-year-old farmer and president of the Arakan Community Seed Bank Organization (ACSBO).

"In 2006, ACSBO came into the picture because farmers wanted their community seed bank to continue even after the project ended," explained Dr. Rosa Fe Hondrade.

"An important benefit of being a member of the community seed bank is that, if my crop fails, I can borrow seeds from another farmer," said Hernani Dumalag, 59 years old. "If I need a variety of seed, I can barter even a small amount of rice, let us say, 5 kilos. Besides, buying seeds from a seed producer is expensive."

Aside from the benefit of readily accessible seeds, farmers know the source and the quality of the seeds. Thus, the community seed bank provides an informal guarantee of quality.

On-farm conservation

"The community seed bank in Arakan achieved a momentum that allows farmers access to the seeds they need while maintaining biodiversity," said Dr. Casiana Vera Cruz, senior scientist at IRRI and CURE work group leader for upland farming areas.

Arakan's community seed bank is categorized as *in situ* conservation (or on-farm conservation). In contrast to off-farm conservation (gene banks), *in situ* conservation allows "farmers to be stewards of crop diversity—they grow varieties as a way of conserving them and preserving plant genetic diversity," Dr. Vera Cruz explained. "By increasing the diversity of varieties that farmers grow and preserve through active use of traditional varieties, particularly those with useful traits such as good grain quality, adaptability, resistance to many biotic stresses, and tolerance of abiotic stresses, farmers can

JACK ALBERTO S. HERRERA (3)

FARMERS HERNANI Dumalag and Nestor Nombreda benefit from the community seed bank by having access to good quality seeds.

increase yield and reduce disease and pest problems."

Plant genetic diversity is perhaps more important to farmers than any other environmental factor. It provides them and breeders with options to develop, through selection and breeding, new and more productive crops that are resistant to pests and diseases and are well adapted to changing environments.[2]

More productive crops

Genetic diversity made it possible for plant breeders to develop new high-yielding modern rice varieties, which the Arakan Valley team introduced to farmers. These varieties were shown on demonstration during farmers' field days for farmers to judge how modern varieties perform when it comes to yield, grain quality, and resistance to pests and diseases, among other factors important to farmers.

"Farmers can then make an informed decision on what to sow on their respective farms," said Dr. Edwin Hondrade, CURE key site coordinator of USM.

With ACSBO knitting the Arakan farm community closer together, it becomes easier for farmers to share their experiences on the type of varieties they grow, their farming practices, and their seed health management practices.

In short, the community seed bank was widely accepted in several villages of Arakan, and the local government unit even recognized and supported it.

Amidst progress

So much has changed in Arakan since the 1990s. "Going to the upland areas of Arakan from Kidapawan, its nearest city, used to take almost a half day," noted Dr. Vera Cruz. "But now, it takes just over an hour. Gone are the rocks that speckled the unpaved roads, which made them rougher and more slippery during the wet season."

Now, a long stretch of cement roads connects farms to markets. North Cotabato has been transformed from the fifth-poorest province in the Philippines in 1998 into one of the progressive provinces and a favorite investment area in the region.

This influx of investments transformed some of the upland rice areas in Arakan into plantation crops, particularly the revival of old and new rubber plantations. Rubber trees did make some Arakan farmers financially well-off. This

KNOWN FOR its aroma and good eating quality, Dinorado fetches a good price in the market.

ISAGANI SERRANO

[1] Zolvinski S. 2008. Listening to farmers: Qualitative impact assessments in unfavorable rice environments. IRRI Technical Bulletin No. 12. 47 p. (http://snipurl.com.listen_to_farmers).

[2] Rao NK. 2004. Plant genetic resources: Advancing conservation and use through biotechnology. African Journal of Biotechnology 3(2):136-145.

economic progress became evident with some changes in the Valley: some nipa huts became houses of stones; the usual sight of horses tied to a tree became pickup trucks and utility vehicles; plus, some signs of development here and there—a gasoline station, a grocery store, and a hospital.

With rubber sap priced at almost US$1 (40 pesos) per kilogram, a farmer can earn as much as $2,300 (more than 100,000 pesos) from a hectare of a 6-year-old rubber plantation. As the trees mature, this gives more income to farmers. And, farmers can sustain this potential income until the trees reach 25 years old.

But what has become of the upland rice farmers in Arakan Valley? Are they a case of poverty caught in the midst of progress?

Those farmers who converted their rice areas into rubber plantations earlier are reaping the benefits of their investments, whereas some others still need to wait for a year or two before they start to tap their rubber trees.

Surprisingly, despite the popularity and the potential income from rubber plantations, the Arakan farmers did not stop cultivating rice. For them, nothing beats the security of having some rice saved for their consumption. For this reason, ACSBO continues to be relevant even with this change in the community.

HUSBAND AND WIFE Dr. Edwin Hondrade and Dr. Rosa Fe Hondrade helped mobilize the Arakan community seed bank.

ISAGANI SERRANO

In fact, "ACSBO is so successful that it has become a model in nearby towns," said Dr. Edwin Hondrade.

The more, the better

Crop diversification is also promoted in Arakan. "We always encourage farmers to grow different rice varieties as well as crops," said Dr. Edwin Hondrade. "A kind of insurance in case one variety or crop fails."

This strategy was proven helpful in 2011 when most of the rice crops in Arakan failed because of rat and pest infestations. Because many kinds of rice varieties were sown, some varieties survived. It can be noted that most farmers mentioned modern variety UPL Ri5 as having survived.

SOME RICE areas in Arakan are converted to rubber plantations because of higher potential income from rubber.

JACK ALBERTO S. HERRERA (2)

"UPL Ri5 has been preferred by both growers and local rice traders for almost two decades since it was introduced by the USM team," said Dr. Rosa Fe Hondrade.

Seed banking with a twist

The Arakan farmers often cultivate Dinorado as a cash crop, but the well-off farmers, on the other hand, grow Dinorado for their food. Among Arakeños, "no other rice can compete with its taste."

Under the leadership of municipal agricultural officer Edgar Araña, Dinorado, Arakan's priority product, is listed under the "one town, one product" program of the national government. That is why knowledge of good seed health practices is of great value for the Arakan community.

Moreover, the community seed bank model has been embraced by the local government unit of Arakan, but *with a twist*. It applies the principles and practices of a community seed bank to develop and preserve its exotic Dinorado variety, and it promotes organic farming. "Applying 'organic amendment' to the Arakan Dinorado brand further increases its value," Mr. Araña said. "It can be sold for up to 80 pesos (almost $2) per kilogram." This is more than double the price of standard types of rice in the Philippines.

For Mr. Araña, the local government unit is not only preserving Arakan's Dinorado and conserving biodiversity but also nurturing the soil—the "source of life"—on which rice grows. "Organic farming is friendly to the environment and healthy for humans," he said.

SOME MEMBERS of the Arakan Valley team: (L-R) James Dulay of the local government unit of Arakan, Dr. Edwin Hondrade of the University of Southern Mindanao, Arakan municipal agricultural officer Edgar Araña, Dr. Casiana Vera Cruz of IRRI, and Mr. Enrique Layola of the Department of Agriculture.

Within the context of conserving the "source of life," in 2009, the local government unit established the Land Utilization Program for Sustainable Livelihood of Arakeños (LUPA, the Tagalog word for soil). The LUPA conducts farmers' field schools that incorporate community seed banking and organic farming.

In addition, Mr. Araña shared that the community seed bank has an ecotourism aspect, which is deemed a spillover success. "People are interested in visiting Arakan to see how its exotic Dinorado is cultivated organically."

Confessions of a "backslider"

Although organic farming is believed and followed faithfully by members of the LUPA, there are some "backsliders."

"We are called 'backsliders' because we reverted back to using chemicals such as pesticides and herbicides," farmer Nestor Nombreda said.

"If one's area is small, hand weeding is okay," he explained. "But, if the area is more than a hectare, it is difficult to weed by hand."

A farmer's choice

Whether it is about the type of rice varieties to cultivate or the methods of farming practiced, "farmers have to judge the opportunities available to them and what suits their conditions best before they decide for themselves," said Dr. David Johnson, IRRI weed scientist and CURE coordinator.

"It is important that we offer farmers options, as we recognize that farmers often know better than we do in many ways," he added.

Surely, the community seed bank has helped farmers in Arakan. They learned how to produce good-quality seeds that resulted in an increased seed supply of a culturally important traditional variety that fetches a high price such as Dinorado and a high-yielding modern variety such as UPL Ri5. Now, with access to modern varieties, they can have more stable and better yields that can stand up to unfavorable conditions. As a result, more and more farmers will no longer experience food insecurity and hunger.

HINUMAY, LAMBOG, and Amma are among the traditional varieties that farmers grow in Arakan Valley.

LANIE REYES

HEIRLOOM IN THE MOUNTAINS

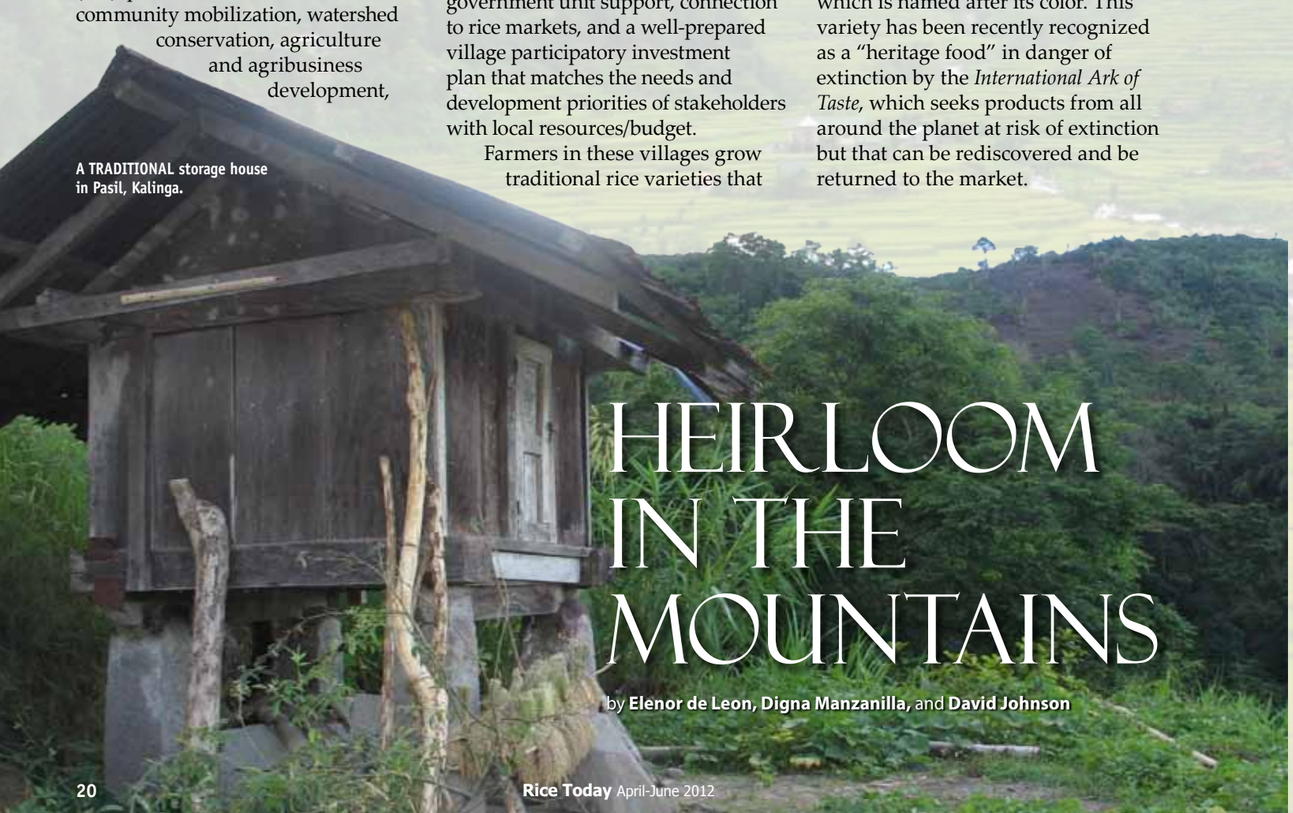
by **Elenor de Leon, Digna Manzanilla,** and **David Johnson**

Farmers in the Cordillera region of the Philippines actively preserve their "heritage" rice varieties

Most organizations working toward sustainable development believe that giving people money does not get rid of poverty. Instead of giving "doles," empowering people and communities to take control of their situations has been deemed a more sustainable approach.

In the Philippines, the second phase of the Cordillera Highland Agricultural Resource Management Project (CHARMP2) works to reduce poverty and improve the quality of life of rural communities in the highlands of the Cordillera Administrative Region (CAR). The CHARMP2 project, an International Fund for Agricultural Development (IFAD) investment within the Department of Agriculture (DA), provides interventions such as community mobilization, watershed conservation, agriculture and agribusiness development, the promotion of income-generating activities, and the development of rural infrastructure.

Recently, CHARMP2 forged a partnership with the Consortium for Unfavorable Rice Environments (CURE), which is coordinated by the International Rice Research Institute (IRRI). Through this, CHARMP2's development interventions will hopefully be strengthened with the support of CURE. In turn, the partnership will enable CURE to introduce and extend technological options over a wider area.



A TRADITIONAL storage house in Pasil, Kalinga.

Threatened heirlooms

Under CHARMP2, three remote upland villages—Bagtayan in Pasil, Kalinga; Fiangtin in Barlig, Mountain Province; and Bangbang in Hungduan, Ifugao—are the focus of the collaboration with CURE. These villages were selected because they have existing activities that are in line with CURE's goal, which is to empower local rice growers to reduce poverty. Also, they have strong local government unit support, connection to rice markets, and a well-prepared village participatory investment plan that matches the needs and development priorities of stakeholders with local resources/budget.

Farmers in these villages grow traditional rice varieties that their ancestors have cultivated for hundreds of years. In Bagtayan, heirloom rice varieties are classified according to the season when they were grown—dry season (Unoy) or wet season (Uyak) and whether they are glutinous (Alig, Lachok, and Yonga) or nonglutinous (Chong-ak, Chumalling, Ifuwan, Finuga, Chiplog, and Ginonnaw).

AN EXTENSION worker in Hungduan, Ifugao, examines a rice plant with blast.

ELENOR DE LEON (3)

In Fiangtin, farmers grow the rice variety Mountain Violet (or Ominio), which is named after its color. This variety has been recently recognized as a "heritage food" in danger of extinction by the *International Ark of Taste*, which seeks products from all around the planet at risk of extinction but that can be rediscovered and be returned to the market.

Farmers of Bangbang also have a range of traditional rice varieties such as Oklan, which comes in white, red, and green forms, and Minaangan, a traditional red rice. Also, they have a "sticky" rice variety called Diket, which literally means to stick.

Best practices for conservation

Revitalize Indigenous Cordilleran Entrepreneurs (RICE) Inc. is a Filipino nonprofit, nongovernment organization that aims to preserve these heirloom rice varieties and the culture of community rice production that surrounds them in the Cordillera region. Farmers have noted that the purity and quality of their traditional rice varieties have deteriorated through the years, so they see the importance of restoration or preservation of these varieties. They also face many production problems related to changes in weather and infestation of rodents, pests, and diseases.

RICE Inc. buys rice from the farmers at prices higher than those in the local market and sells it in the United States. For this market, however, farmers have to follow higher standards in terms of selection of acceptable seeds, harvesting, drying, milling, and storage. The organization also discourages farmers from using pesticides, despite problems of rodents, earthworms, and rice blast disease in their fields.

In Bagtayan, farmers have observed that applying mineral fertilizers affects the distinct aroma and taste of Unoy, a local dry-season variety. These mineral fertilizers are difficult to obtain because of the inaccessibility of their village. Farmers have therefore adopted organic farming methods, such as the Korean-inspired method that uses fermented plant juice. They also use botanical insecticides, or plants that have insecticidal properties. It is reported that about 100 plants in the Philippines have insecticidal properties that could be used to control pests. Farmers here are also taught the *Palay Check System* from the DA in combination with indigenous practices through the farmers' field school.

Across the villages, farmers are concerned about several problems: their rice terraces are eroding, their rice yield is low and unstable, and they need to intensify their crop to improve their farm productivity and income. Farmers also worry about a lack of interest in rice farming among the younger generation, who prefer to seek work elsewhere. This means that no one else will preserve their tradition and maintain the productivity of their rice system (see *Contours of change* on page 8-13 of *Rice Today* Vol. 3 No. 1).

Where two points meet

To improve the livelihoods of the farmers in the remote areas of northern Luzon, CHARMP2 links with rural communities in the area and partners with CURE to help provide rice technologies to benefit farmers. Together with farmers, they conduct meetings and site visits in the three villages and produce participatory videos that show a combination of indigenous and modern methods of farming.

REPRESENTATIVES FROM IRRI-CURE Dr. Digna Manzanilla and Dr. Casiana Vera Cruz, along with Dr. Nenita Desamoro (PhilRice), and Mr. Ceferino Oryan (municipal agriculturist of Barlig, Mt. Province), meet the members of the Kadaclan Farmers' Association, to explore possible areas for collaboration.

The farmer-beneficiaries and CHARMP2 staff document their best management practices for them to share their knowledge and experiences with other farmers on topics such as nutrient management in an organic system. Project staff members also provide training on participatory process documentation, which includes organizing, analyzing, and documenting field-based information and reporting in various formats and media.

Other activities include participatory adaptive research and varietal selection in the highlands of Kalinga, technology clinics to respond to problems of rice blast and other diseases, organic farming, and disseminating technologies such as trap barrier systems for rodent management (see *Building a better rat trap* on pages 34-35 of *Rice Today* Vol. 4, No. 2). As an example of success elsewhere, the introduction of community-based trap barrier systems in Vietnam and Indonesia has successfully reduced farmers' use of chemicals by up to 66% and 50%, respectively; helped them increase yields by up to 0.5 ton per hectare; and significantly reduced their costs of rodent control.

As a good working synergy, CURE, CHARMP2, and the farmers greatly helped in the process of responding effectively to the needs of the community. Involving farmers in activities such as varietal selection, adaptive research, and documentation not only empowers the farmers but also sustains development in the community.

Ms. de Leon is a communication specialist at IRRI, Dr. Manzanilla is a social scientist at IRRI and CURE associate coordinator, and Dr. Johnson is a senior scientist and CURE coordinator at IRRI.

Sensing cash through satellite data

by **Parvesh Chandna, A. Nelson, J.K. Ladha, U.P. Singh, Raj Gupta, M. Punia,** and **B.S. Sidhu**

Named after the twin river systems, the Indus and the Ganges, the Indo-Gangetic Plain (IGP) is South Asia's major food-producing region that comprises parts of Pakistan, Nepal, India, and Bangladesh (Fig. 1). More than one billion people—one-seventh of the world's population—live in the IGP.

With the ever-increasing population as the backdrop, the major challenges in the IGP are to satisfy the food demand of the people who live there and improve their livelihoods and to preserve its natural resource base.

Large tracts of land in the middle and lower Gangetic Plains are either uncultivated or underused after the rice harvest during the kharif (wet) season, including rice-fallows (under 6.7 million ha), flood-prone riversides (or *diara* lands, 2.4 million ha), waterlogged areas (4.9 million ha), and salt-affected soils (2.3 million ha).

Improved resource-conserving technologies, such as zero-tillage, can give farmers in these areas new ways to grow rice and wheat that increase productivity and profitability as well as input efficiency. But, different resource-conserving technologies suit different areas and it is not a case of one technology fits all.

To make sure the right resource-conserving technology is delivered to the right area, it helps to know first the extent and distribution of these "problematic" lands (salt-affected soil or waterlogged areas). The International Rice Research Institute (IRRI) has done this by obtaining spatial information at the field or village level from high-resolution remote-sensing data. Once a problem in an area is identified, the technology that is most effective in overcoming the problem can be promoted and shared with local farmers.

Studies conducted by IRRI and the International Maize and Wheat Improvement Center (CIMMYT) in the IGP show that remote sensing-based technology targeting (Fig. 2) can bring immediate impact and can provide more income to farmers. For example, farmers stand to gain a potential income increase of US$63 per hectare by targeting raised beds in salt-affected soils; $250 per hectare by introducing submergence-tolerant rice varieties (e.g., Swarna-Sub1 varieties); $800 per hectare by introducing boro rice (November-April) in waterlogged areas; and $581 per hectare by introducing zero-till when growing lentil in rainfed fallow lowlands.

Farmers can earn $147 per hectare by timely planting zero-tillage wheat. They could earn an additional $180 per hectare by growing a short-duration mungbean crop after the harvest of drill-seeded zero-till wheat.

Remote sensing-based technology targeting has an enormous potential to increase the efficiency of technology transfer and impact assessment. The methodology is already proven and can be applied to more than 15 million hectares of underused IGP lands. If precisely applied, all this can add an income of more than $3 billion each year to these poverty-prone areas (Table).

Dr. Chandna is a remote-sensing and GIS scientist at IRRI-India; Dr. Nelson is a geographer and head of the GIS Lab at IRRI-Philippines; Dr. Ladha is a principal scientist and IRRI representative in India; Dr. Singh is a professor at Banaras Hindu University, India; Dr. Punia is an associate professor at Jawaharlal Nehru University, India; Dr. Gupta is a consultant at The Borlaug Institute of South Asia, India; and Dr. Sidhu is the director of the Department of Agriculture in Punjab, India.

Table. Estimates of achievable additional income from underused lands from Ballia District of Uttar Pradesh and the Eastern Gangetic Plains.

Ecology/regime	Ballia District (part of Eastern IGP)					Eastern Gangetic Plain of India	
	Conventional farmers' practice[a]	Targeted technology	Estimated area (ha) in Ballia District	Income versus the conventional practices (US$/ha)	Achievable additional income in Ballia ($/ha × 10^6)	Estimated area (million ha)	Achievable additional income (million US$ per year)
Late-planted wheat areas	CT-BCW	ZT-DSW	86,550	147	11.2	2.6	378.4
Sodic land	CT-BCW	BED-DSW	43,560	63	2.3	2.3	146.9.
Excessive soil moisture (rabi)	Fallow	ZT-BCW	11,170	356	4.7	0.5	172.6
Waterlogged (kharif and rabi)	Fallow	BCR-DW + (CT-TPR-boro)	12,243	565	6.9	4.9	2,745.9
Tal/rainfed lowland/diara land	CT-BC-lentil	ZT-DS-lentil	80,334	66	5.3	2.4	158.4

[a] CT-BCW = conventional till–broadcast wheat, CT-BC-lentil = conventional-till-broadcast lentil, ZT-DSW = zero-till drill-seeded rice, BED-DSW = raised-bed drill-seeded wheat, ZT-BCW = zero-till broadcast wheat: surface seeding, BCR-DW= broadcast rice-deep water, CT-TPR-boro = conventional-till-transplanted boro rice, ZT-DS-lentil = zero-till drill-seeded lentil

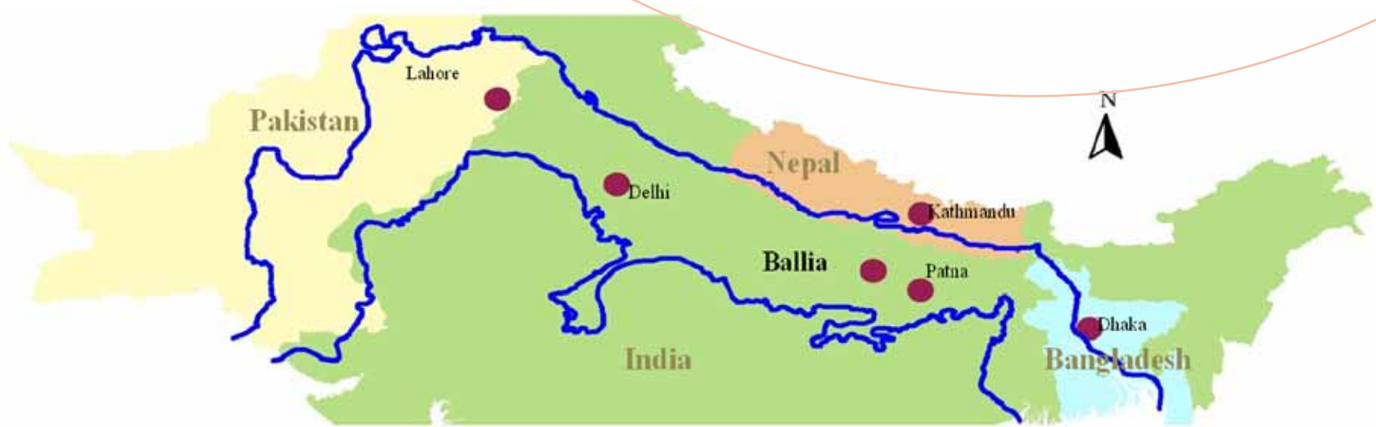


Fig. 1. Re-delineated map of Indo-Gangetic Plain (blue line) of South Asia and location of Ballia (unpublished: Chandna 2012).

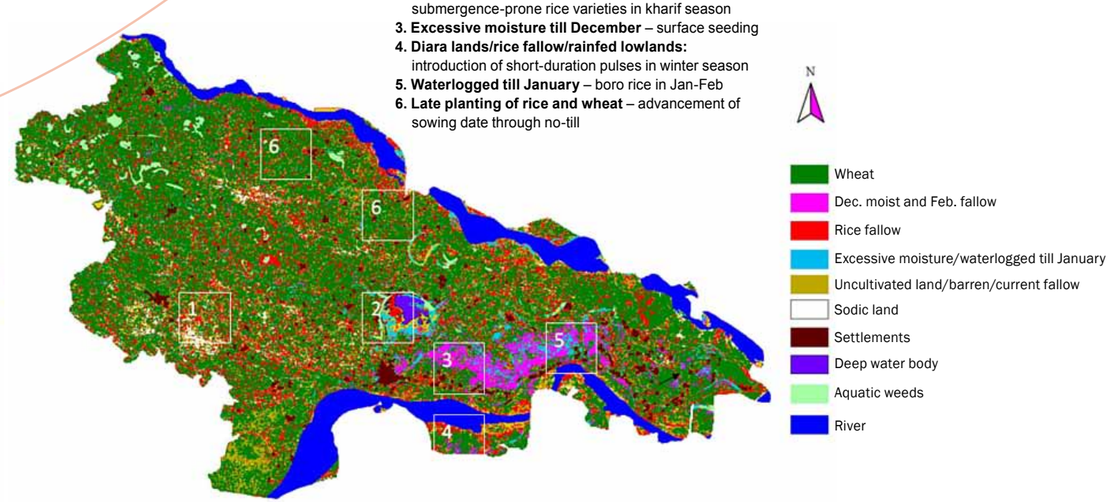


Fig. 2. Potential target options for underused lands in Ballia District of Uttar Pradesh, India.

R. Raman, AfricaRice

African women may gradually do less manual labor, such as this winnowing of rice in Glazoué, Benin. Mechanization is moving forward rapidly in Africa through the adoption of threshers and other farm equipment that can speed up the postharvest process and produce grains with high quality and high market value.

That rice you throw away

by **Aileen Macalintal**

Every year, millions of tons of rice are wasted; finding ways to prevent this loss could help the Philippines save rice

A family of five cooks a kilogram of rice in a pot for breakfast. Somebody forgets about it and it burns—the rice at the bottom of the pot becomes almost inedible. The kids don't finish their meals. Leftover rice is all over their plates and in the pot, which will sit in the kitchen for hours. At the end of the day, the family throws away a plastic bag full of burned and spoiled rice. This is how a family as well as many households and restaurants in the Philippines waste this high-demand political commodity, which feeds half of the world's population.

At first, this fact may not sit well with the Philippines' annual per capita consumption of 120 kilograms, or about 5 cups, of rice per day. Why buy that much rice for the table when a significant amount is thrown away, taking with it all the nutrients and energy that rice can give? National Food Authority Administrator Angelito Banayo has a term for this behavior—*takaw-tingin* (literally, *takaw* pertains to gluttony, *tingin* means sight; the concept refers to impulse buying or acquiring at the sight of things desirable). But, what seems to be wrong with a few grains of rice left on the plate or in the pot? The devil is in the details.

Throwing it away

Research shows that the Philippines, the world's biggest rice importer for several years, wastes rice that is worth at least US$535,000 (23 million pesos) every day, or at least $223 million a year—enough to feed 4.3 million people. The Food and Nutrition Research Institute (FNRI), under the Department of Science and Technology, revealed these 2008 data, further noting that every Filipino wastes an average of 3 tablespoons (9 grams) of rice daily, which is equivalent to 3.3 kilograms per year.

With 94 million people (National Statistics Office 2010) and 9 grams of wasted rice per day (FNRI 2008), the total wastage is 308,000 tons: 36% of the 2011 rice imports.

Wasted grams per head actually vary in different regions across the Philippines. FNRI's National Nutrition Survey shows that on one of the three island groups of the Philippines, Luzon, daily rice and product wastage is 16 grams per capita and 12 grams each for the other two, Visayas and Mindanao. Also, middle-class families tend to waste more than low-income families. Apparently, the more people have, the more they waste.

If the Philippine figures cause deep concern, global figures for "throwaways," plus postharvest losses, can be alarming.

Chain of waste

A Food and Agriculture Organization (FAO) study, "2011 Global food losses and food waste," revealed that a third of global food (1 billion tons) is wasted. Part of this is cereals (including rice). Losses in rice come from the unmilled grains through poor harvesting and postharvest activities, inefficient transportation, inadequate storage, wasteful processing, and market spoilage.

The first rice wastage happens after harvesting. Cited in the report, losses during agricultural production happen when rice grains spill and degrade during handling, storage, and transportation between the farm and distribution to markets (wholesale, retail, supermarket, and wet markets).

CHRIS QUINTANA

MOISES JOHN C. REYES

IRRI

BROKEN PARTICLES, discoloration, partial removal of the bran (due to undermilling), and black spots (due to insect damage)—such disturbances in this mix of rice kernels count as postharvest waste.

Consumption, when the final wastage takes place, usually results in throwaways (due to "bad cooking") or leftovers. "Perhaps one of the most important reasons for food waste at the consumption level in rich countries," explained the FAO report, "is that people simply can afford to waste food."

How much food is lost and wasted in the world today and how can we prevent this? "These questions are impossible to answer precisely, and not much research is going on in this area," lamented the report. With global population now more than 7 billion people and continuing to increase and food production having difficulty catching up, a lack of critical attention to this is surprising.

Preventing waste, saving lives

Will it be hard to change the wasteful eating habits in the Philippines? According to Flordeliza Bordey, an economist at the Philippine Rice Research Institute (PhilRice), "If we look at the trend of the two FNRI surveys (2003 and 2008), it is not impossible to influence the seemingly wasteful eating behavior of Filipinos." Campaigns on raising awareness can be a key to this.

Dr. Bordey, who is also the program leader of PhilRice's impact evaluation, policy research, and advocacy, said that PhilRice launched a rice awareness campaign in 2011, as part of its celebration of rice awareness month (November). "The messages of this campaign are 'eat your rice right' and 'save rice, save lives,' which advocated reducing rice waste at the consumer level," she added. The activities included a fun run, university visits, and Facebook blogs.

According to Dr. Bordey, PhilRice proposes a similar campaign during the national year of rice in 2012. Approved by the Department of Agriculture, this campaign aims to reach out to more consumers.

The hundred tons of rice wasted each year, not just in the Philippines but in the whole world, need to be taken seriously. Our social conscience will tell us that the rice we waste (or money, for that matter) can just be the very rice we need to feed the hungry and the undernourished.

As research institutions take part in securing food for the next generations through high-yielding crops, consumers must also help solve problems in food scarcity through responsible consumption, so that everyone will have enough to eat.

It takes sound business principles and planning to introduce farm equipment in a sustainable way

JOSEPH RICKMAN (7)

Humans and machines

by **Joseph Rickman** and **Paula Bianca Ferrer**

A farmer's life has never been an easy one. Before farmers can reap the full benefit of their harvest, they have to do many energy-sapping tasks: plowing, planting, irrigating, weeding, harvesting, threshing, transporting, and storing.

Traditionally, most activities on small rice farms require long hours of work, using a lot of family labor or energy. Studies show that, for each ton of rice produced, more than 7,000 megajoules of energy are needed, whether provided by humans or machines.

In physical terms, work or energy is a function of force and distance. The more force you need to apply or distance you need to travel, the more energy is required. The faster you accomplish this, the more power you exert. When humans or animals work in the field, the problem is that they can supply only a finite amount of energy at a given time. When they get tired, efficiency drops and so does the quality of work.

Are machines the answer? Although humans and animals have limited energy over time, machines don't get tired, and they can get the job done much faster without sacrificing quality of work.

For instance, to plow a hectare requires 150 person-days to finish, 12 days when animals are used, a day with a 2-wheel tractor, and 1–2 hours with a 4-wheel tractor. The same amount of energy of about 1,500 megajoules is required to do the job. The difference is in the time.

Aside from time, labor cost should also be considered. Using a machine or hiring a contract service provider is cheaper. The cost for one-pass plowing using animals, a 2-wheel tractor, or a 4-wheel tractor is US$40–50 per hectare depending on the locality while manual labor costs more than $200 per hectare, and the job done is no better than the mechanical output anyway.

In terms of harvesting, hand harvesting and threshing cost $100–120 per hectare and hand cutting with mechanical threshing costs about $80 per hectare, which is similar to combine harvesting that costs $80–100 per hectare.

When a machine is introduced into a farming system, it often brings with it other benefits. The engine can be used as a power source for other machines such as threshers, water pumps, and electricity generators. Moreover, a farmer who owns a machine such as a 2-wheel tractor or thresher can do contract service work for other farmers.

Technical loopholes

Good management and understanding of the machine and the farming environment are all critical and should not be overlooked. For example, when mechanical threshers were brought to Mozambique from Asia, all had broken down with mechanical problems within 2 months. The cause of the problem was that farmers had always cut the straws long enough for easy grip when they manually flailed them over a drum to release the grain. However, mechanical threshers require short straws to be efficient.

Another problem encountered was that the farmers normally left their rice crop in the field until the moisture dropped to 15–16%, which made it easier for threshing. The mechanical threshers, however, were designed to thresh grains at 20–22% moisture, which not only gets the crop out of the field 3–4 weeks earlier but also gives higher grain yield of a better quality. Farmers who were not used to managing grain with high moisture thus faced a problem. This resulted in a second technology, solar grain drying, which could dry the grain to 14% moisture for safe storage.

The biggest lesson here is that it's very important to analyze the entire production chain before introducing new equipment.

Gears in place

In rice-producing countries where mechanization is at an early stage, many nuts and bolts have to be in place to develop a sustainable industry. Experiences from Asia and from some parts of Africa indicate that farm equipment can be introduced in a sustainable way through sound business principles and planning. Governments, training institutes, international organizations, NGOs, financial institutions, and the private sector all have a role to play.

The government's main role is in the importation and testing of new equipment, as well as in the development of import and tax policies that support importers, dealers, and local manufacturers. Vocational training institutes need to develop curricula that focus on mechanization and can provide both technical and basic business planning and training for operators, mechanics, and artisans. Extension offices and NGOs need training to extend and support mechanized agriculture. Credit institutions need to be encouraged to structure loans to suit farmers and contract service suppliers.

Most importantly, there must be champions for rice mechanization who will link to all the stakeholders and who must be supported by the government to drive the process—from introduction to adoption.

Mr. Rickman is an IRRI senior scientist and regional coordinator for East and Southern Africa.

Small equipment: A big hit in Africa

by **Joseph Rickman**

A number of examples in Africa tell stories of how farmers have successfully adopted small-scale equipment, which is now being manufactured locally.

The model of adoption has generally been the same. Once a suitable machine is identified, it is tested under a range of local conditions, modified when necessary, promoted by the government, and then linked to a local entrepreneur.

The use of locally manufactured mechanical threshers in Senegal is one very good example (see story on pages 30-31). When this equipment imported from the International Rice Research Institute in the Philippines was brought to Africa, the government, together with the Africa Rice Center and a local manufacturer, extended its use to the broader farming community. Now, more than 400 of these threshers—which have been adapted to local conditions—are being used in Senegal.

In Tanzania, more than 600 two-wheel tractors, which were imported from Thailand, are now being widely used for rice production. Local dealers in Dar es Salaam support these tractors by supplying spare parts and training operators in using and maintaining the equipment. In Madagascar, locally manufactured mechanical weeders have been adopted widely. These weeders were originally imported from Asia but are now being fabricated locally.

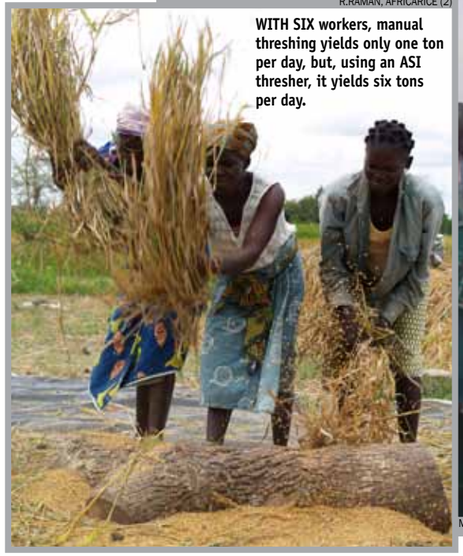
In all of these cases, adoption and promotion have been based on sound business principles, without government subsidies. ■

The little machine that could

by **Savitri Mohapatra**

Africa shifts from back-breaking operations to almost labor-free threshing

R.RAMAN, AFRICARICE (2)



WITH SIX workers, manual threshing yields only one ton per day, but, using an ASI thresher, it yields six tons per day.

PARTICIPANTS AT a meeting on "Boosting agricultural mechanization in rice-based systems in sub-Saharan Africa," under the Global Rice Science Partnership (GRiSP), inspect a mini-combine prototype designed by a local manufacturer.

MARCO WOPEREIS, AFRICARICE

AN ASI thresher is being used at the Institut d'Economie Rurale (IER), Niono, Mali.

The excitement of rice farmers in Saint-Louis, Senegal, upon seeing an appropriate engine-driven small-scale thresher from Asia in the mid-1990s could not have been far different from that of the first American president, George Washington, in 1796, when he was expecting the first horse-powered threshing machine to arrive from London. He described the new machine as one of "the most valuable institutions in this country; for nothing is more wanting and to be wished for on our farms."

The Asian rice thresher, which the Senegalese rice farmers appreciated, was sent by the International Rice Research Institute (IRRI) upon request by the Africa Rice Center (AfricaRice). It was expected that this thresher could be locally manufactured and mounted to serve as an alternative to manual threshing.

The making of ASI

Thanks to an innovative partnership forged between national and international research and extension organizations, local artisans, farmers' organizations, and the private sector, an improved rice thresher for the Senegal River Valley (the principal zone for irrigated rice in the country) was soon developed. Based on the IRRI prototype, it can reduce the drudgery associated with hand threshing and improve yield and marketability of rice.

Substantial modifications were made to the original thresher, including doubling its capacity, making it more robust by using sturdier material, increasing its processing power, and adding two wheels to make it a four-wheel version.

Named "ASI" after the three main partners—AfricaRice, the Senegal River Valley National Development Agency (SAED), and the Senegalese Institute of Agricultural Research (ISRA)—the thresher went through several adaptations to ensure that it met the requirements of producers and women rice farmers engaged in threshing activities.

ASI was commercially released in Senegal in 1997. Since then, ASI has become the most widely adopted thresher in Senegal, with major impact on the rice production chain.

A study showed that, with six workers, ASI yields six tons of paddy per day vis-á-vis one ton by manual threshing and four tons by Votex, the alternative small-scale thresher that was available in the Senegal River Valley. Moreover, with a grain-straw separation rate of 99%, no additional labor is required for sifting and winnowing compared to Votex, which could not properly separate grains from straw after threshing.

In other words, it reduces labor requirements, freeing up family members, particularly women, for other useful tasks; speeds up the postharvest process; allows production of a higher quality product with lower risk of damage; and increases the marketability of local rice in the face of imports.

Recognizing its immense value for the country as a technical solution that is acceptable to everyone in the rice-growing community, including women, the Grand Prix du Président de la République du Sénégal pour les Sciences (Special Prize of the President of Senegal for Scientific Research) was conferred in 2003 on the ASI thresher team. The team included AfricaRice Deputy Director General Marco Wopereis, who had served as an agronomist in the Saint-Louis Station of AfricaRice in the '90s and was closely involved in all the stages of ASI's development.

An impact study conducted by AfricaRice in Senegal 12 years later in 2009 showed that ASI continued to be one of the most important improved postharvest technologies in the Senegal River Valley, helping irrigated rice farmers to cope with labor scarcity. For farmers, the ASI thresher is a time- and labor-saving device with a high grain recovery rate.

Spreading across the region

As ASI's popularity grew among the rice farming community and its impact continued to ripple outward and change the lives of rural households, the experience in Senegal was successfully extended to several West African countries (Côte d'Ivoire, Burkina Faso, Ghana, Mali, Mauritania, etc.), where each country further adapted the machine to suit its own specific conditions and released it under different brands.

ASI has recently spread to Central African countries Cameroon and Chad. Here, the local artisans, who were trained by AfricaRice and partners, were inspired to develop a series of modified prototypes for various crops. In 2011, the Chad government gave ASI high praise at the country's 50th anniversary celebration, where local ASI models were publicly displayed.

Why ASI clicked

Labor is a serious concern in sub-Saharan African agriculture since many labor-intensive tasks in crop production are carried out manually. For example, rice threshing and cleaning are manually carried out predominantly by women, who spend hours on these back-breaking operations. This not only affects their health but also the grain quality and profitability of rice.

Field surveys carried out in the '90s in the Senegal River Valley revealed that the lack of improved practices and machinery resulted in postharvest rice crop losses of up to 35% and poor grain quality due to inefficient manual threshing.

The surveys also revealed other constraints, such as the frequent shortage of labor during rice harvest and postharvest periods and the unsuitability of existing systems that were too costly, time-consuming, or labor-intensive during peak labor demand. Consequently, paddy may sit in the field for weeks or even months waiting to be harvested or threshed; quality then deteriorates because of exposure to the elements and shattering.

Therefore, in response to the demand from rice stakeholders, AfricaRice decided to adapt and introduce ASI in the region by creating a coalition of partners.

The partnership model made the technology relevant. AfricaRice is now using this model to forge a new partnership and alliance to further develop rice harvest and postharvest technologies in sub-Saharan Africa.

Now, the Center is introducing and adapting a small affordable combine harvester in the Senegal River Valley for timely harvesting and threshing. The adapted prototype combine harvester, which is under tests, not only harvests small farm plots more quickly, but also provides threshed and bagged grain of high quality, making it more attractive to local traders.

Given the examples of ASI and the mini-combine harvester introduced by AfricaRice and its partners, a number of rice stakeholders from sub-Saharan Africa who met in July 2011 to develop a road map for sustainable mechanization of the rice sector emphasized the value of small-scale, locally adapted machinery specifically targeting labor-intensive activities.

They also recommended that governments consult research when importing machinery to ensure its efficacy and durability under African farming conditions, and that capacity be built to provide after-sales support for farm machinery. Thus, the ripples created by ASI continue to expand.

RICE OF Deities

More than nourishment for the body, African rice is also a worthy offering to the gods

by **Alaric Santiaguel**

Three thousand years ago, African rice (*Oryza glaberrima*) was first domesticated in central Niger in West Africa and then spread to the rest of the continent. For thousands of years, it sustained the economies of many precolonial African kingdoms in West and Central Africa. But, African rice has been overshadowed by its Asian relative, particularly since the early 20th century.

The decline of *O. glaberrima* began after the First World War, when colonial powers occupying West Africa promoted only Asian rice cultivars. Asia's varieties went through seed multiplication and distribution programs of development projects that mainly catered to the colonizers' commercial interests. The decline of *O. glaberrima* continued after the Second World War.

Old rice in a new world

African rice was initially ignored by mainstream research, said Dr. Koichi Futakuchi, ecophysiologist at the Africa Rice Center (AfricaRice). Historically, researchers were interested only in passing on beneficial traits, such as resistance to pests and diseases, from African rice to Asian rice. Recently, however, the world has "rediscovered" African rice and more researchers are working on improving African rice by introducing genes from Asian rice.

Although it is prone to lodging, has lower yields, is harder to mill, and has panicles that scatter the seed at maturity, African rice is known for its toughness.

Its larger leaf area makes it more efficient at shading out weeds. African rice is also more tolerant of severe climates, drought, flood, iron toxicity, infertile soils, and human neglect (see *Beware of bronzing* on pages 38-39 of *Rice Today* Vol. 10, No. 3).

African rice was crossed with Asian rice in the 1990s to create NERICA (NEw RICe for Africa) varieties that can have both *O. glaberrima*'s adaptability to indigenous environments and *O. sativa*'s high yield potential. NERICA proved to be widely successful. Several upland NERICA varieties are already available as well as lowland ones that are adapted for both rainfed and irrigated lowlands.

NERICA, however, does not signal the end of pure African rice. New findings presented by AfricaRice scientists and their partners during the 2010 Africa Rice Congress sparked renewed interest in *O. glaberrima* (see *Pockets of Gold* on pages 32-33 of *Rice Today* Vol. 9, No. 2). Scientists at AfricaRice believe that improved, high-yielding *O. glaberrima* varieties, armed against Africa's multiple abiotic and biotic stresses, have tremendous potential and can play a vital role in the region's food security.

Divine offering

African rice is also important in the spiritual realm of some African people. In fact, its value in sacred rituals saved African rice from the onslaught of Asian rice in pockets of small communities, such as the Jola (or Diola) people in southern Senegal, according to Olga Linares, staff scientist emeritus at the Smithsonian Tropical Research Institute in Panama. The Jola engage in large-scale rice cultivation and agrarian activities, and measure a person's wealth by the amount of rice owned.

Those who have not converted to Islam continue to practice *awasena*, their traditional religion, and worship the supreme deity Emitai, Dr. Linares noted in her book *Africa rice: history and future potential*. The Jola believe that Emitai, the creator of all life and the bringer of rain that sustains them, gave *O. glaberrima* (also called Diola rice) to their ancestors. As such, it possessed a life-giving power that explained the origins of the land. To preserve the link to their ancestors and to the rain god, the Jola make sure that varieties of *O. glaberrima* are always planted.

Oryza sativa displaced many traditional African rice varieties at the turn of the century. However, one variety, the salinity-tolerant Ejonkin, remains popular among the Jola who inhabit marshy terrains, according to Dr. Linares. Although it is perfectly suited in areas where daily tidal flow occurs and continuously floods the area with brackish water, Ejonkin is mainly cultivated to gain the favor of the rain-shrine called *Husurah*, she noted. Only African rice is considered a suitable offering in exchange for abundant rains. Ejonkin is so important to this ritual that communities that no longer cultivate African rice varieties would trade 10 jugs filled with palm wine for a jug of Ejonkin, Dr. Linares added.

Rice and the supernatural

Heirloom cultivars have been used in ceremonies all over the world to appease the spirits. The link between crops and ancestors is a fundamental pillar of most agrarian societies, said Dr. Linares. She cited the Mende people, an ethnic group of mostly farmers, in Sierra Leone where African rice is a major part of their ritual sacrifices to their ancestors. The Mende believe that their ancestors and Ngewo, creator and ruler of the universe, gave their community protection and fertility.

In 1981, a PhD dissertation reported that some members of the Susu tribe of Sierra Leone, Senegal, and Mali practice folk Islam, a combination of the Islamic faith and their traditional animistic beliefs in ghosts, spirits, and other gods.[1] They fear witches who have the power to cause harm through black magic.

To protect their rice fields against witchcraft, the Susu rice and millet farmers use Saali forê, an African rice variety from French Guinea (now Guinea-Conakry).[2]

African rice in South America

The spiritual ties that bind Africans to their rice have endured distance and even the shackles of slavery.

Oryza glaberrima reached South America via the slave trade ships carrying Africans from rice-growing regions such as Sierra Leone, Liberia, Côte d'Ivoire, and Ghana. The Africans were brought to Dutch Guyana (now Suriname) to work on plantations in the late 17th and early 18th centuries.

Preferring to live under the unforgiving conditions of the Amazonian wilderness as free people, some slaves escaped and banded together in forest and mountain settlements, forming a resistance movement until they built autonomous communities. They became known as Maroons.

R. RAMAN

SOME BELIEVE that African rice possesses life-giving power and serves as the link between them, their ancestors and their rain god.

Maroons preserved much of their African cultural heritage, including their rice, according to Tinde van Andel, a postdoctoral researcher studying medicinal and magic plants of Suriname, Ghana, Benin, and Gabon at Leiden University in the Netherlands. Mercenaries hired to re-capture slaves reported extensive rice fields in cleared swamps surrounding temporary rebel camps.

Forest rice

Maroons claim that their rice originally came from Africa, through seeds smuggled into the settlements by a female ancestor who hid them in her hair. However, one legend documented by Dr. van Andel narrated how a hunter accidentally came upon the garden of an extraordinarily powerful *apuku* (forest spirit).

Some Maroons believe that all present-day African rice in Suriname originated from the seeds that their ancestors had collected from that mysterious rice swamp made neither by Maroons nor human beings. The belief that the rice field was made by a spirit of the deep woods may have led to the name *mátu alísi* (forest rice) and Maroons living in Suriname (Saramaccans) claim the crop was growing wild before they started to cultivate it, Dr. van Andel noted.

Maroons deem African rice valuable in their rituals as they offer it along with other food items to the Earth Mother in a ritual called *nyannyan mofu nayan*, according to Dr. van Andel. The offering is known as *ala mofo nyan* (food for all mouths, meaning an offering for all ancestors or gods). Appeasement of ancestors is among the most important ceremonies of the Saramaccans.

"How this mysterious rice swamp ever came to be, which rice was growing there, and whether it was related to the legend of the woman who hid the rice in her hair, we will probably never know," Dr. van Andel said. "However, the importance of Maroon oral history and ritual practices in the conservation of the different rice cultivars is evident."

[1] Thayer JS. 1981. Religion and social organization among a West African Muslim people: The Susu of Sierra Leone. PhD dissertation, University of Michigan, 387 p.
[2] Teeken B et al. 2010. Advocating the integration of socio-cultural factors in models for variety dissemination. Paper presented at the 28th International Rice Research Conference, 8-12 November 2010, Hanoi, Vietnam. OP03: The Social and Cultural Dimensions in Rice Farming and Communities.

What's cooking?

Panfried glutinous rice with shiitake mushrooms and chicken

This fried glutinous rice (with chicken and mushrooms) is a family favorite among most Malaysian Chinese, who usually gather on weekends either at home or in a restaurant. This dish is a variation of the steamed glutinous chicken rice wrapped in lotus leaves (*Lo mai kai*) served at a Dim Sum restaurant.

Fried glutinous rice can be served as a main course or as a snack, or can be eaten straight from the pan piping hot, and accompanied by freshly brewed Chinese tea.

CHRIS QUINTANA (2)

by **Alexis Faulkner**

Ms. Faulkner is Malaysian Chinese and lived in the United Kingdom most of her life after leaving Malaysia at the age of 17. She studied hotel catering and management and worked in various hotels in London and some countries in Europe. On her return from Europe, she switched paths and worked as an accountant in the private sector. Cooking has always been her passion and she spends most of her days in the kitchen experimenting with different ingredients and adapting recipes to local availability.

Ingredients

250 grams (8.8 oz) glutinous rice (soaked for at least 4 hours, best overnight)
1 whole Chinese sausage (sliced)
6–8 pieces dried shiitake mushrooms (soaked for 2 hours)
300 grams (10.5 oz) uncooked chicken breast/leg (thinly sliced)
1 tablespoon sesame oil
2 tablespoons soy sauce
1 teaspoon oyster sauce (optional)
Salt and pepper to taste
100 mL water
2 cloves garlic (skinned and finely chopped)
1 tablespoon cooking oil

Garnishes

Carrot (julienned)
Spring onions
1 teaspoon sesame seeds (lightly toasted)

Directions

1. Drain the soaked glutinous rice in a colander.
2. In a small bowl, mix sesame oil, soy sauce, and oyster sauce, then set aside. Remove the soaked mushrooms from water and squeeze dry. Flatten them, slice thinly, and add to the marinade of soy sauce and sesame oil. Mix thoroughly.
3. Slice the chicken as desired and mix with the mushrooms, then marinate.
4. On a medium setting, heat a tablespoon of oil in a frying pan. Add chopped garlic. As the garlic browns, add the drained glutinous rice and stir gently, coating all the grains with oil.
5. Continue stirring the rice. As the pan dries out, drizzle a tablespoon of water over the rice. As the contents of the pan sizzle, gently turn the rice to ensure thorough cooking.
6. Do not add water too quickly as this will soak the rice, making it wet and mushy.
7. When the rice grains are almost transparent, taste a few grains. Glutinous rice is cooked when it is chewy.
8. Push the rice to the side of the pan and add the marinated chicken and mushrooms. Stir-fry for a minute and then mix in the rice with the chicken and mushrooms, and add a little water if required. When the chicken is cooked, add the Chinese sausage slices and another tablespoon of water and gently mix everything. Allow the water to evaporate and continue turning the mixture until the rice begins to crisp and brown.
9. Serve immediately and garnish with spring onions, julienned carrot, and sesame seeds.

Serves 6.

Watch Ms.Faulkner demonstrate how to prepare this scrumptious dish in a 5:08 video on YouTube at http://snipurl.com/panfried_rice.

A chance in the wild

by **Ma. Lizbeth Baroña**

Wild rice may help other rice varieties survive harsh conditions and deliver high yields

THE WILD relatives of rice are repositories of important traits that help breeders improve rice.

IRRI (2)

Scientists are scouring the deep and "wild" end of the rice gene pool to help find hidden traits and genes that can help breed new rice varieties better at thriving and producing food in difficult environments.

Although the genetic diversity of cultivated rice is already rich, widening its diversity through its wild relatives is significant, as they possess high-value traits that can help breeders make new rice varieties that can stand up to climate change and other challenges.

Rice has wild or undomesticated relatives, called "wild rice," that are rich repositories of genetic material that can provide tolerance of environmental stresses and help improve yield. Wild rice diversity is considered to be in the periphery of the rice gene pool, with the center being around varieties cultivated from the two main species of rice: *Oryza sativa* and *O. glaberrima*. In total, there are 27 species of rice.

Wild rice's richness in desirable traits, such as pest and disease resistance, is borne out of centuries of surviving in harsh environments—untended and away from human intervention. These important traits have been infused in cultivated varieties to help protect them against pests and diseases that have affected thousands of hectares of rice farms and have caused millions of dollars of damage.

Helping farmers

The International Rice Research Institute (IRRI) and its partners carry out rice improvement activities using wild rice traits. By way of conventional breeding and modern biotechnological tools, these crucial traits are transferred to cultivated varieties and have resulted in rice varieties with improved resistance to bacterial blight, blast, tungro, brown planthopper, and soil toxicity.

To name a few species, wild rice *O. minuta* gave breeders genes that contain resistance to bacterial blight, blast, brown planthopper, and sheath blight. Resistance to tungro virus, on the other hand, was found in wild rice *O. rufipogon*.

The opportunities are expanding as more is learned about how to explore the diversity in wild rice to improve cultivated rice. Dr. Kshirod Jena, head of interspecific hybridization breeding at IRRI, stated, "We have now succeeded in transferring genes from almost every species in *Oryza*, giving access to the full range of genetic diversity in the genus.

"Our latest important result is the transfer of a gene with resistance to brown planthopper from *O. australiensis* to a high-yielding brown planthopper-resistant variety for cultivation in South Korea," said Dr. Jena. "This variety is called Anmi. This is a significant achievement because host-plant resistance is an effective way to control brown planthopper—a pest that has rendered hundreds of millions of dollars in damage across Asia.

"From the same wild rice, *O. australiensis*, we have identified a blast-resistance gene that will soon be infused in cultivated varieties," Dr. Jena explained. "But perhaps the brightest prospect from wild rice is that we at IRRI are in the process of transferring yield-enhancing genes from *O. rufipogon*. In the future, we will develop new varieties that are not only resistant to pests and diseases, but that are also able to give better yield."

ALL RICE types, including their wild relatives, are conserved in this wild rice screenhouse at IRRI.

IRRI-GRC

Getting information from wild rice

It is not too much of a stretch to say that agriculture is slowly being pushed into a corner where it is expected to deliver more food with less land, water, nutrients, and other inputs. Not only do farmers have to deal with the blows of climate change to farming environments all over the world, but they will also have to feed 5 billion rice-eating people by 2030.

New rice varieties must adapt to these challenges, meaning that rice plants will have to be bred to produce more food by "arming" them with traits that can stand up to heat, flood, drought, salty soil, pests, and diseases.

Scientists at IRRI and elsewhere depend on the natural genetic diversity of rice for adaptation. Many challenges are yet to be predicted; hence, the conservation and exploration of the genetic diversity of rice—including wild rice—become even more important.

IRRI is also working on genetic sequencing: decoding the genetic information behind the diversity of rice to truly unlock its potential for breeding. Only a few types of rice have been sequenced; however, the sequence of these few types of rice does not reflect the immense genetic diversity of all types of rice—or the very unique diversity in wild rice.

IRRI's "wild" conservation

IRRI has been conserving the genetic diversity of rice in the International Rice Genebank for decades. There are now more than 114,000 types of rice kept in the seed vaults, and almost 4% of these are wild relatives.

Dr. Ruaraidh Sackville Hamilton, head of IRRI's T.T. Chang Genetic Resources Center, stressed the importance of being able to collect and catalogue these wild species. "In nature, wild rice grows mainly in unprotected habitats, which can easily be destroyed by urbanization and farming," he cautioned. "We have to conserve these types safely where we can study them without risk of extinction."

The wild relatives of rice conserved in the International Rice Genebank, alongside many heirloom and modern varieties, are available for sharing with rice breeders and others, all over the world. With this diversity at their fingertips, rice breeders can continue to bring together the best traits from wild rice and the best traits from domestic rice to provide rice farmers with improved rice varieties to face the challenge of feeding the world.

MA. SOCORRO ALMAZAN, curator of wild rice at IRRI's Genetic Resources Center, has been working with wild rice for years.

COUNTRY HIGHLIGHT:

IRRI and Japan

Compiled by **Lovely Merlicel Quipot**

Japan is the only industrialized country whose agriculture is based on rice, its staple food. Rice cultivation in Japan was introduced from China between 13,000 and 300 BC. Since then, rice farming has had a great influence on the social structure and culture of the country.

Its rice ecosystems occur across a wide range of latitudes, including the subtropical, temperate, and subtemperate zones. Almost all rice is grown in summer under irrigated conditions. Most of its rice fields are on the plains of the country's major river basins, but many rice fields are also found on terraces and in valleys.

Sacred rice

In the 13th century, rice was Japan's currency before China introduced metal, and rice had a political role—the rank of a feudal lord was determined by the amount of rice he produced or by the size of the rice-producing area of his territory.

In addition, the Japanese retain a unique regard for rice. For them, it is sacred. This reverence for rice is attributed to Shintoism, a Japanese religion. Shintoists believe that an emperor is a descendant of the creator of Japan, and that natural things and phenomena have deities—in rice resides the deity of food. This belief, among others, makes locally produced rice superior and totally different from foreign rice for the Japanese people.

Early rice science

The earliest recorded experiments on rice were in the 1400s and 1500s to determine its maturity, cultivation, traits, and glutinous properties.

By the 1800s, many farmers were carefully selecting rice varieties for planting. Afterward, the National Agricultural Experiment Station in Japan began selecting pure lines of rice varieties as soon as the station was established in 1893.

In 1905, Japan developed a rice seeder, called "octopus," that could seed 16 hills in one move, and it was then widely adopted by farmers. Come 1910, the pedal thresher was invented in the country.

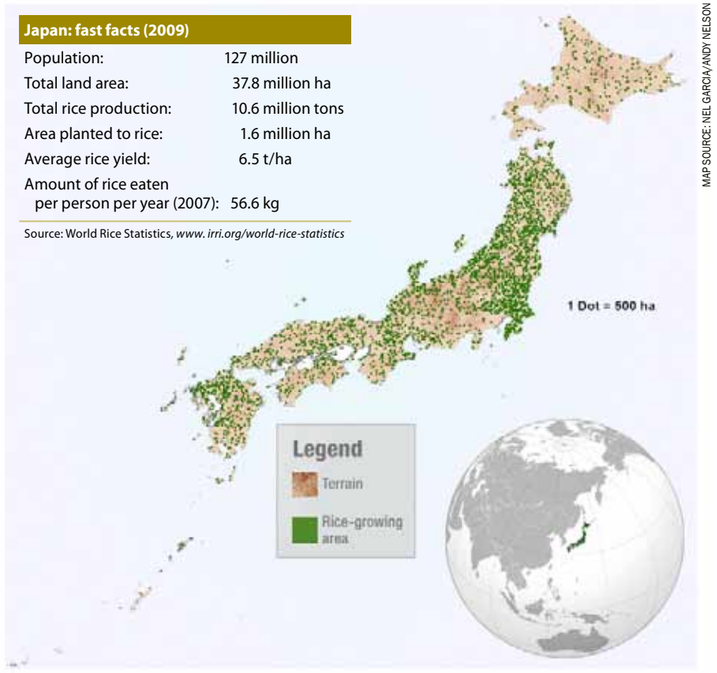
Japanese rice breeders began developing varieties for cold tolerance in 1935, and for blast resistance in the 1940s. They developed a series of rice varieties that had stiff straws, upright leaves, good response to fertilizer, and high yield potential.

In the early 1960s, rice consumption per capita was nearly 120 kilograms. Because of a high demand for rice, the government invested in research to generate better rice varieties and production techniques. The government even led a contest in search of a rice farmer with the highest yield in the country—the winner produced around 10 tons per hectare during that time.

Japan: fast facts (2009)

Population:	127 million
Total land area:	37.8 million ha
Total rice production:	10.6 million tons
Area planted to rice:	1.6 million ha
Average rice yield:	6.5 t/ha
Amount of rice eaten per person per year (2007):	56.6 kg

Source: World Rice Statistics, *www. irri.org/world-rice-statistics*



MAP SOURCE: NEL GARCIA/ANDY NELSON

A pioneering partner

Japan has been an important partner to the International Rice Research Institute (IRRI) since the Institute's establishment. It provided leadership by having a seat on the first IRRI board of trustees in the person of Dr. Hitoshi Kihara in 1960. Since then, Japan has always been represented on the board, with Dr. Mutsuo Iwamoto as its current representative.

Japan has also long been one of IRRI's most generous supporters, giving a total of more than US$191 million to IRRI between 1971 and 2010. Japan became a member of the CGIAR in 1972.

Past research collaboration

In its partnership with Japan, IRRI covers a wide range of rice research. In 1984, Japanese scientists were assigned by the Japan International Research Center for Agricultural Sciences (JIRCAS) to work at IRRI headquarters under the IRRI-Japan Collaborative Research Project.

In the 1980s, research activities focused on developing low-nitrogen-input technology and on identifying genes that are resistant to various races of bacterial leaf blight disease. Then, in 1989, IRRI and Japan collaborated on rice double cropping. In 1994, their research concentrated on the adaptability of rice to water stress and blast disease. Under the Japan Capacity-Building Program, Japan continued to support breeding for blast resistance.

Japan also invested in research for better postharvest equipment that is now being adopted in Southeast Asia.

Moreover, the Japanese government has also supported social science research under the Japan-IRRI shuttle program. Through intensive field surveys in Asian villages, the research revealed how farmers rapidly modernized their farming once high-yielding varieties were introduced. It showed that modern rice technology has a significant impact on poverty alleviation, particularly among marginal farmers.

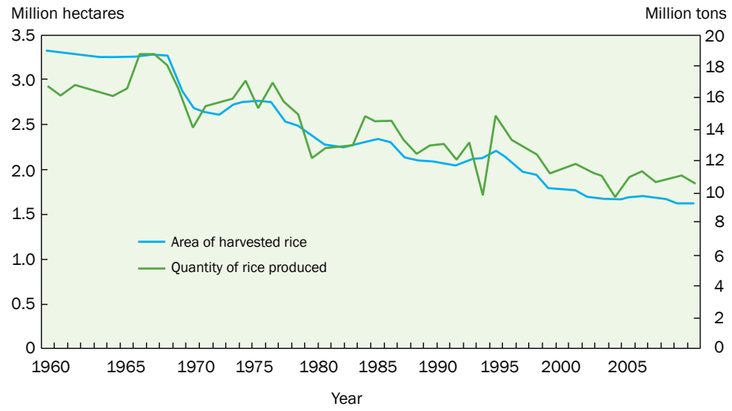


Fig. 1. Rice production area and quantity in Japan (1960–2009).
Source: World Rice Statistics

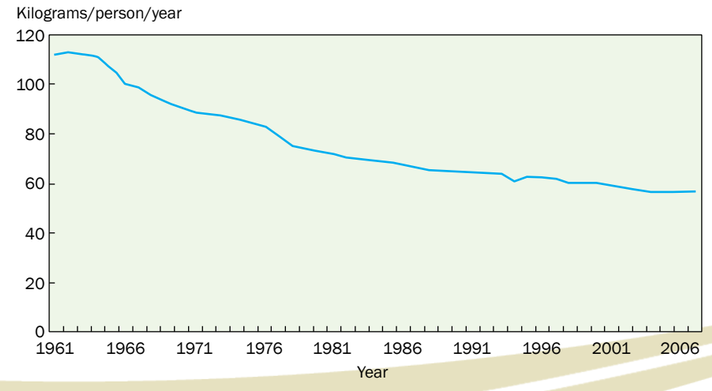


Fig. 2. Average rice yield in Japan (1960–2007).
Source: World Rice Statistics

Japan has also supported IRRI to deliver rice market information and develop integrated rice cultivation systems under water-saving conditions. Japan also supported the successful development of submergence-tolerant rice (Sub1 rice).

Current work

IRRI and Japan are now working together in using molecular breeding techniques to develop high-yielding rice varieties under unfavorable conditions, such as drought. Several genes that help rice cope with drought stress have been previously identified and characterized by Japanese research groups at JIRCAS and RIKEN (a large natural sciences research institute).

Climate Change Adaptation in Rainfed Rice Areas (CCARA) is an ongoing research project under IRRI-Japan collaboration. It aims to develop a decision support system in rainfed lowland rice production based on seasonal weather prediction.

It is noteworthy to mention that, through JIRCAS and the Japan International Cooperation Agency (JICA), the country has also been a founding strategic partner in the Global Rice Science Partnership (GRiSP), being led by IRRI. Under this mega-program, activities include acceleration of the development of high-impact varieties in sub-Saharan Africa and Southeast Asia; acceleration of rice variety testing, approval, and dissemination to these regions; the building of a new generation of rice breeders; as well as conducting socioeconomic surveys.

Lastly, IRRI and JICA, working together in a project to train extension agronomists, recently brought 25 participants from five African countries (Mozambique, Kenya, Rwanda, Uganda, and Tanzania) to the Philippines for a 17-week rice knowledge, production, and extension course (see YouTube video: http://youtu.be/YzHAsbCA0a4).

8 driving forces in global agriculture

USDA's export agency identifies eight key factors that will dominate global agriculture in the next 10 years

Agricultural commodity prices will remain high for the next 10 years. Income growth in most developing countries will rise. Commodity prices will remain strong and will boost long-term farm sector profitability and encourage more investments in research and production that will improve yields and increase production area.

The Foreign Agricultural Service (FAS), the export arm of the United States Department of Agriculture (USDA), identified eight key factors that will dominate global agriculture in the coming decade.

by **V. Subramanian**

1. Rise of the middle class

Economic growth—especially from emerging markets—is expected to drive the global economy, as the middle-class population is estimated to double within the next 10 years. Following the recession in 2010—the worst recession in decades—growth and development, particularly in developing countries, will prompt future growth despite the current economic weakness in developed regions such as the U.S., Europe, and Japan. The middle class from developing countries is estimated to expand up to 104% until 2020, compared with 9% from developed countries. Much of the increase will come from China and India (see figure). Interestingly, while the threat of a new global recession looms, the rise in the middle-class demographics will not only create a significant global food demand but also reveal higher income elasticity for food in emerging markets. Consequently, it will affect consumption patterns, as buying decisions based on price and food choices can shift quickly between commodities.

2. Falling dollar

USDA expects the agricultural trade-weighted value of the U.S. dollar to weaken further through 2021 and thus put more upward pressure on commodity prices. Commodity prices are inversely related to the dollar, and a relatively weaker dollar raises a foreign buyer's purchasing power and hence demand for those commodities. Since 2002, the U.S. currency has been trending down and most private economists believe that its value will ease against a broad range of currencies.

3. Demand for biofuel

Demand for feedstock such as grains, vegetable oils, and sugar has been boosted by the continuously expanding production of global biofuels, especially in the U.S. and the European Union, driven by the Renewable Fuels Standard in the U.S. and the Renewable Energy Directive in the European Union. In total, 36 countries (mostly in the Western Hemisphere) have adopted policies encouraging the use of biofuels. There is, however, a "new generation" of biofuels that are not based on food crops (such as algae), which could help reduce the world's reliance on food-based feedstock for energy.

4. Trade liberalization

After a 150% increase in trade liberalization since 2000, trade has grown to $700 billion and it is projected to cross the $1 trillion mark by 2020. China and Southeast Asia, in particular, have seen a significant increase in trade, and the growing list of Free Trade Agreements at bilateral and regional levels is expected to fuel production growth in exporting countries.

5. Policy "errors"

Restricting exports is usually a reaction to market scares such as shrinking supplies and inflation. However, export bans distort markets and increase world prices just like the rice crisis in 2008. Moreover, although these decisions boost the domestic market and reduce food inflation in the short term, they also lower producers' prices and profitability, thereby affecting long-term production. These policy measures also discourage investors since their earnings will be subject to unpredictable government actions.

6. High input and energy prices

Agriculture is about planting, harvesting, transporting, and processing. When energy-intensive inputs such as diesel, fertilizers, and agricultural chemicals become more expensive, farmers' profits and output are affected. The limited sources of energy and global growth of the middle class are anticipated to drive energy prices up.

7. Increasing role of biotechnology

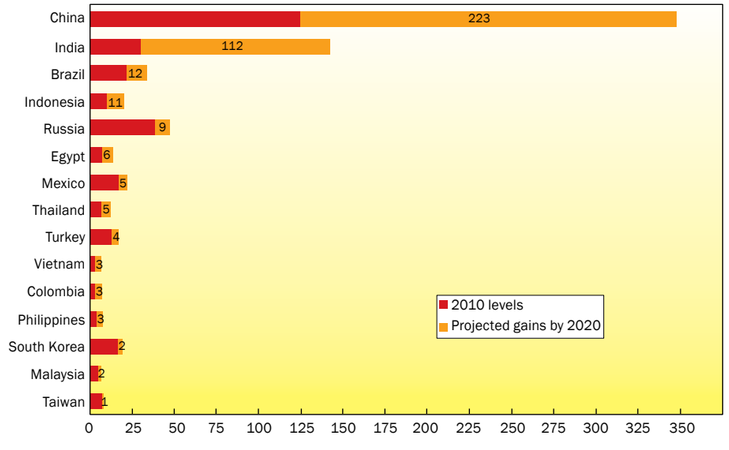
Between 1996 and 2010, an 87-fold increase in area of biotech crops made them the fastest-adopted technology in the history of modern agriculture. In 2011, 16.7 million farmers grew biotech crops—and over 90% of them (or 15 million) were small resource-poor farmers. Hence, developing countries grew close to 50% of global biotech crops in 2010 and they are expected to exceed similar output from industrial countries by 2015. Based on this trend, biotechnology will have a bigger role in developing agricultural production to support future needs.

8. Increase in production area

Production is also expected to receive a boost from increases in cultivation areas, particularly from South America (Brazil) and the former Soviet Union (Russia and Ukraine). Africa also offers a massive land resource, but, given its poor infrastructure and relatively high transport and distribution costs, its role in supporting increased production looks limited, for now.

These eight points reveal key indicators that can shape global agriculture in the next decade. Asia will drive much of the demand, as this region's economy (particularly China and Southeast Asia) is expected to grow the fastest, alongside the Middle East, North Africa, and Latin America. In the near future, though, a new recession in Europe and, consequently, a slowdown in economic growth in China could sooner or later curb the growth of the middle class in emerging markets (a major factor in many of the points raised). Such a recession could also increase the value of the dollar, cut global trade, reduce all dollar-denominated commodity prices, and lower farm incomes. In other words, it might challenge almost every point that had been identified as a key factor that would drive global agriculture. This possibility, however, would seem to only delay, rather than prevent, the overall positive outlook.

Developing countries with fast-growing middle class.



Source: Global Insight's global consumer markets data as analyzed by Foreign Agricultural Science/Office of the Global Analysis.

This article is based on a speech presented by Mr. Michael J. Dwyer at the USA Rice Outlook Conference in Texas. Mr. Dwyer is the director of global policy analysis of the USDA Foreign Agricultural Service.

Hidden Treasure*

Global variables

As I write this article, The Rice Trader is just returning from the TRT Rice Network 2012 event in Dubai, United Arab Emirates. It was a one-day networking seminar, with some nice social events for members of the global trade.

We found Dubai to be quite fascinating, given its mix of various cultures and people from different walks of life. Also, the Burj Khalifa, the tallest building in the world, was particularly interesting as the immensity of this engineering feat was amazing to behold. We also got to appreciate the beautiful musical fountain show, which runs every 30 minutes from 6 to 11 p.m. It was even hard to pull one of our staff away, after an extended picture-taking session. The experience was striking as it reminded us that, wherever we go in the world, we will always meet new people and see new things.

Our next big event is in Miami, Florida, USA, on 1-4 May 2012. Talks on the trade in this region include the market's direction in the coming months and views on this critical time in the market. Among the networking events we arranged is a luxury yacht tour around the Miami Bay to give participants a nice experience.

Moving on to the action in the market—or the lack thereof—we are in the midst of a very interesting dilemma in the rice industry. Markets are actively moving and price volatility has been a major concern of late. Similar to what happened in 2008, the major food grain markets seem to be up for a rather interesting period in 2013 given the changing price of food relative to the high (and rising) price of oil (at US$105 per barrel at the time of writing). Notably, oil could be the single most important variable in the cost of production, which will affect global production and consumption trends.

Furthermore, like in 2008, the prices of rice lag behind the prices of other grains. The only difference today is that the rice market appears to have ample supplies, especially with India back in the picture (even though it is no longer exporting aggressively compared to the final quarter of 2011, after the government lifted the ban on nonbasmati rice exports in September 2011).

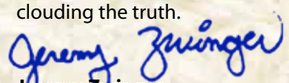
Many players forecast that India will export more than 5 million tons in 2012, and that it will have enough, if not more, supplies of rice (along with wheat) to keep the world's food grain balance in check—unless a major unexpected event occurs such as a poor monsoon season or if the Indian government passes its Food Security Bill, which will prioritize having ample stocks of food (such as rice) instead of exporting stocks. Note, however, that India's return and its massive stocks raise a red flag despite the fact that the cheap bumper crop has already moderated the impact of Thailand's prices, which increased when the Thai government bought rice from farmers at a higher price.

India has to be watched because high supply and low prices could leave a trail of negative impacts on the market. For instance, investments in future production might decline if oversupply pulls prices down, and supply may see an imbalance if demand continues to grow, partly because of the relatively lower domestic prices of rice.

One also needs to keep an eye on the U.S., as questions surround how the country will ration demand long enough for the South American players to return, to pick up the slack and help supply importing countries. Also, a lack of strength in rice futures combining with a strong push toward other (more profitable) food grains may bring U.S. rice production lower than initially thought. This is further complicated by South America's significantly smaller rice crop in 2012. The price of oil and the rising cost of production are key concerns in the short to medium term, which is expected to drive growers to shift to other crops that use less fertilizer and fuel. Additionally, medium-grain rice production may decrease largely because of poor prices, better crop alternatives, and a lack of water, particularly in California.

Because of this increasing shift away from rice production in the U.S.—and even in South America—Asia, to some degree, will fill the gap and supply some of these two origins' traditional export markets. Add political dynamics and the equation becomes more complicated. Will the U.S. allow other exporters to take away its markets in Haiti and Central America, which it fought hard for?

Indeed, Asia will have a bigger role when it comes to supplying the world, and one has to wonder if the spread between rice prices and the increasing cost of production will have an impact on the market's future direction. Certainly, we can expect many more surprises before the truth is known. Frankly, we feel concerned when the market is too bearish or too bullish; right now, the amount of negativity in the market is so great that perhaps it is clouding the truth.



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.

Is Thai supremacy ending in the global rice market?

by **Samarendu Mohanty**

Thailand has been the largest rice exporter in the world for nearly five decades, when the volume of Thai rice exports steadily increased from 1 million tons in 1974-75 to more than 10 million tons in 2010-11 (Fig. 1). The country's share in the global market peaked at 43% in 1988-89; since then, it has been fluctuating between 25% and 30%. During this period, however, global rice trade has tripled from 11 to 33 million tons in the wake of trade liberalization among many countries in the late 1980s and the 1994 General Agreement on Tariffs and Trade (GATT).

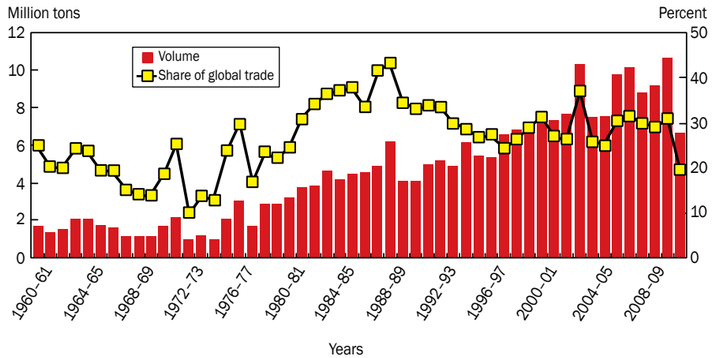


Fig. 1. Thai rice exports.
Source: USDA (2012)

As part of their GATT market access commitments, countries partially opened up rice trade, which increased the volume more than 50% in the past decade. The expansion of trade came along with the emergence of Vietnam and India as growing exporters in the global rice market. In the last decade, Vietnam and India together have accounted for nearly a third of global rice trade. Despite losing market share, Thailand has been able to steadily increase its volume of exports and maintain its status as the largest exporter in the world.

In late 2011, the newly elected Thai government reintroduced the rice pledging scheme, which was part of its election promise for the 2011 main crop, by raising the price that the government pays farmers for rice by almost 50%. Between October 2011 and February 2012, nearly 7 million tons reportedly entered the rice pledging scheme from the main rice crop. This occurred despite significant crop loss due to floods. As expected, the government extended the current pledging scheme, from the end of February to September 2012.

Current status

As reported in our price and market blog[1] in September 2011, the pledging program encouraged Thai farmers to expand their rice area in response to higher price support and to offset last year's crop losses due to floods. The United States Department of Agriculture (USDA) now projects the 2011-12 Thai rice crop to be 20.3 million tons of milled rice, which is more or less the same as the previous year's production.

In addition, rice has been diverted from the market to warehouses, and Thai exporters have been priced out of the export market. Unfortunately, India's grand entry into the nonbasmati export market, after 4 years, has made matters worse for Thai exporters. The quoted prices for Thai white and parboiled rice were higher by nearly $200 per ton than their Indian counterparts during the initial months after India's resumption of nonbasmati rice exports (Fig. 2). However, this price difference has narrowed with the steady decline in Thai price quotations in recent months, but then again the price difference still remains around $100 per ton.

India's record production in 2011 and swelling procurement stocks continue to keep India in the export market. Supported by a weak rupee, India's exports remain overly aggressive in racking up sales. In this price war, Vietnam also lost some market because of its high quotations, which closely followed Thai prices.

[1] See http://bit.ly/GHpMhh.

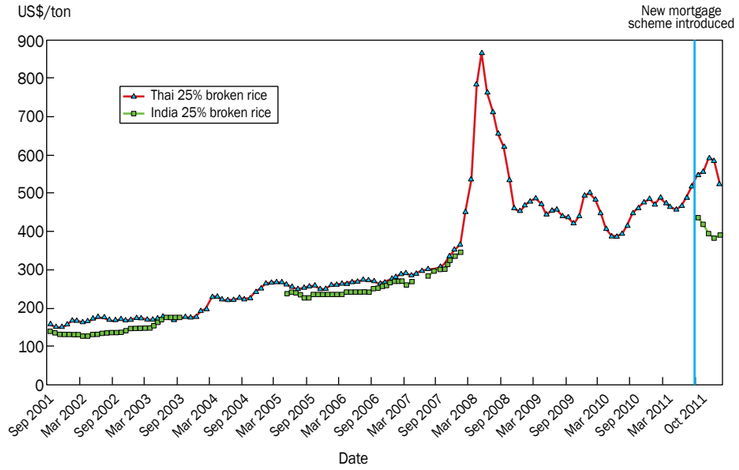


Fig. 2. Prices of "Thai 25% broken" and "India 25% broken" rice showing the date of introduction of Thai's pledging scheme.
Source: FAO Rice Monitor

USDA now projects Indian rice exports for 2011-12 to be 6.5 million tons, which is the same as the projected exports from both Thailand and Vietnam in the same marketing year. This is nearly 40% lower than what Thailand exported in 2010-11: 10.5 million tons.

Future prospects

An all-too-important question is thus raised: Is this the end of the dominance of Thailand in the global rice market? The answer to this question is not a categorical "yes" or "no." It depends on developments on several fronts. If Thailand disbands its pledging program, it will keep its top post, at least in the immediate future. But, its stay on top may be short-lived if Myanmar and Cambodia get their act together and modernize their rice sector and reform their policies. Both these countries are endowed with fertile lands and a favorable natural environment that can expand their production and take away market share from Thailand.

In 2011, the Myanmar government took some steps to reform and open up its economy, and recent visits by several high-level government representatives from several countries such as the United States, Britain, and Japan indicate that sanctions on financial services, new investment, travel, and trade may be lifted, or at least relaxed, in the near future.

Moreover, several government initiatives, which aimed to improve the performance of its rice sector for the past years, raised hope for Myanmar's return to the global rice market sooner. One of these initiatives is the establishment of the Myanmar Rice Industry Association (MRIA) in 2010 by merging producers, traders, and millers associations. It aims to speed up the development of the sector by attracting private investment and raising the sector's concerns to the government.

The government has also empowered the MRIA with the right to export, which was previously controlled by the government. Also, several specialized rice companies (SRC) have been established in major rice-growing towns to provide farmers with low-rate farm loans and other services such as farm machinery rentals and paddy purchase. These companies are partly owned by local traders, millers, and farmers, with a majority of ownership held by private investors from urban areas.

Irrespective of what happens to Thailand's status in the global rice market, it is exciting to see the prospect of new exporters in the rice market.

These are a few of the baby steps taken by the Myanmar government in the right direction. The rice sector, which has been affected by decades of extensive government controls, needs more efforts to improve the availability of credit, inputs, and storage facilities. The port facility and financial system, which have been in complete disarray from years of international sanctions, need a major uplift if the country dreams of returning to its old glory of being a major player in the global rice market.

Just like Myanmar, Cambodia also needs to overcome many obstacles, including poor infrastructure (port facility, roads, irrigation, rural electricity, etc.); inadequate availability of credit, inputs, and quality seeds; and other supply chain constraints for its presence to be felt in the international rice market.

If Thailand persists with the pledging program, the emergence of new players in the export market will surely accelerate. The country may be displaced eventually as the largest exporter in the world. But, in the end, it all depends on how fast the global rice trade expands. If global rice trade volume follows the trend of the past two decades, it is possible to have enough maneuvering space for all exporters, including the new entrants. Hence, Thailand will continue to hold on to the top position.

Irrespective of what happens to Thailand's status in the global rice market, it is exciting to see the prospect of new exporters in the rice market. This will definitely bring more stability to the market and improve global food security.

Building trust in rice trade

by Sally Trethewie

Indonesia and the Philippines move toward rice self-sufficiency

Rice availability has been considered a key indicator of food security in Asia for many years. Thus, rice continues to command unrivaled political attention in Southeast Asia, drawing a heavy-handed approach to the rice economy from governments of exporting and importing countries. One recent policy that has been a subject of constant argumentation is the rice self-sufficiency program of two top importing countries—the Philippines and Indonesia.

Toward self-sufficiency

The 2007-08 food price crisis deepened existing distrust between exporting and importing countries, and led to instability in the international rice market. It also triggered strong long-term policy responses that sought to secure domestic supplies and stable prices.

Two of the world's largest rice importers precrisis—the Philippines and Indonesia—have taken steps to be less reliant on the world market. Both pursued substantial rice production initiatives and pledged to be self-sufficient by 2013 and 2014, respectively, and aimed to be net exporters soon after.

In the context of an opaque, thin, and relatively unstable rice trade, the push by the Philippines and Indonesia toward self-sufficiency seems logical to secure domestic supplies and stabilize domestic rice prices. However, this strategic shift will have an impact on the larger regional rice economy.

Securing sufficient local supplies and stabilizing domestic rice prices will come at a substantial economic cost to both countries. Many rice farmers are choosing to diversify production to include or exclusively produce other crops in order to generate a larger income, given the declining economic importance and profitability of rice, as evident in its decreased share in the region's gross domestic product (GDP) from 14.5% in 1961 to just 3.8% in 2007. Hence, sticking to planting rice to produce a sufficient amount may pose economic dilemmas. Furthermore, with limited or no imports, consumers may face increased rice prices as governments support farmers and local rice production by buying rice from the farmers at a higher farm-gate price.

Perhaps the strongest argument for Indonesia and the Philippines to resist isolationist self-sufficiency and to continue to participate in the world rice market is to ensure stability during localized shocks. Although no existing studies examine the costs and benefits of these countries' strategies as they move toward self-sufficiency, general literature on rice trade liberalization suggests that participation in the world market, rather than self-sufficiency strategies, serves to better secure domestic supplies, especially during local market shocks.

Building trust

As they shift toward being stronger producers of rice, the Philippines and Indonesia can generate more trust and enhanced cooperation in the regional rice economy, especially since Southeast Asian countries share similar challenges in food security.

More open engagement with the world rice market would enhance both countries' security in rice supply, resilience to shocks, and opportunities to export.

Both countries could further build on this trust by maintaining and deepening participation in the world rice market. Isolationist self-sufficiency in rice and restricted world market engagement are not viable long-term food security solutions. More open engagement with the world rice market would enhance both countries' security in rice supply, resilience to shocks, and opportunities to export. It would also have an impact of broadening and strengthening the regional rice market. Building trust and confidence in the market through enhanced engagement will be just one step, but it can be a significant measure to promote a more stable Southeast Asian rice economy.

Ms. Trethewie is a senior analyst at the Centre for Non-Traditional Security Studies, S. Rajaratnam School of International Studies, Nanyang Technological University in Singapore.

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