RICE CRISIS
The aftermath

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Rice Today

International Rice Research Institute
October-December 2008, Vol. 7, No. 4

Can organic agriculture feed Asia?

What next for Sri Lanka?

The long road
Is intensive farming sustainable?

Thai rice industry
Shaking the invisible hand

Rice on the up in Africa

ISSN 1655-5422 US$5.00

6th International Rice Genetics Symposium

16-19 November 2009
Manila Hotel, Philippines

For further information:

IRRI 50
1960-2010
Rice Science for a Better World

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The International Rice Genetics Symposium is one of the world's biggest and most important rice research conferences. It provides an important forum for reviewing the latest advances in rice research and for in-depth discussion and exchange of information on classical genetics and genomics.

This four-day event builds on the excitement generated by the sequencing of the rice genome and what this means for the international rice industry. Rice Genetics 6, together with the 7th International Symposium on Rice Functional Genomics, will showcase the latest developments in the field, including research on evolutionary genetics, genome structure and organization, functional genomics, developmental genetics, trait dissection (abiotic and biotic stresses, yield, heterosis, agronomic traits, grain quality, and nutrition), and plant breeding applications.

The program will include plenary and concurrent sessions, evening workshops and satellite meetings, and a postmeeting field tour to the International Rice Research Institute in Los Baños, around 60 kilometers south of Manila.

7th International Symposium on Rice Functional Genomics

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RiceToday
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On the cover: Ethiopian farmer Zeineba Taha in her rice field at Chewaka.

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Rice Today is published by the International Rice Research Institute (IRRI), the world's leading international rice research and training center. Based in the Philippines and with offices in 13 other 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. IRRI is one of 15 centers funded through the Consultative Group on International Agricultural Research (CGIAR), an association of public and private donor agencies. For more information, visit the CGIAR Web site (www.cgiar.org).

Unleashing Africa's rice potential

Most people would agree that the world's biggest fans of rice are Asians. But wait until you hear what Africans have to say about rice:

"Rice is my first husband," proclaims a woman farmer in Benin. "By selling rice, I am able to keep my marriage and stay with my [second] husband and children."

For many African rural women, rice is not just food—it is the family breadwinner. Seen as cash, status, and empowerment, it symbolizes hope for the future.

In Africa, rice is generally considered a woman's crop. Groups of women sowing, weeding, and harvesting with children strapped to their backs are a common sight.

Just as in Asia, rice in Africa is an integral part of many people's culture. The Diola people in Senegal, for instance, say that, at the beginning of creation, their ancestors received from the Rain God the Diola (African) rice, which carried a life-giving power. To this day, the Diolas grow this indigenous rice and use it in rituals to preserve their ancestral links.

Today, rice is grown and consumed in about 40 countries in Africa and is the fastest growing source of food. Because increases in domestic rice production have not kept pace with demand, sub-Saharan Africa is currently in rice deficit. In 2007, sub-Saharan African countries imported about 10 million tons of rice, roughly a third of the total traded on the world market.

Such extreme dependence on imported rice meant that 2008's soaring prices hit African rice consumers hard, provoking food riots in several of the region's major rice-importing countries, such as Burkina Faso, Cameroon, Côte d'Ivoire, Senegal, and Mali.

African leaders have realized that, to avoid severe food insecurity, civil instability, and an economic downturn, they need to urgently boost domestic rice production. Importantly, there is much potential to do so. Current yields tend to be well below their potential and plenty of land and water is available.

Moreover, the Africa Rice Center (WARDA) and the International Rice Research Institute have forged a partnership that, with the help of donors such as the Bill & Melinda Gates Foundation and the International Fund for Agricultural Development, will help the continent improve production substantially in the coming years.

Rainfed (nonirrigated) rice cropping has profited from the development of NERICA (New Rice for Africa) varieties developed by WARDA, but yield gains are expected to be even higher in lowland and irrigated areas.

Rice is economically produced in a wide range of agroecologies in Africa. Recently, substantial advances have been made in understanding the dynamics of rice production systems and in developing technologies designed for African conditions.

It is also important to remember that, for centuries, African farmers have played a vital role as local innovators. Unfortunately, their knowledge is often lost over time or locked up in the memories of families and communities. This is why, according to an old African saying, "Every time an old man dies, a library burns down."

With resolve, hard work, and the knowledge generated by collaboration such as that of IRRI and WARDA, Africa can both maintain its old libraries and build new ones. And, from these, the great rice potential of the continent can be unleashed.

Savitri Mohapatra
Africa editor

Global food situation at a crossroads

IRRI BOARD Chair Elizabeth Woods.

CHRISANTO QUINTANA

Declining agricultural productivity and continued growing demand have brought the world food situation to a crossroads. Failure to act now through a wholesale reinvestment in agriculture—including research into improved technologies, infrastructure development, and training and education of agricultural scientists and trainers—could lead to a long-term crisis that makes the price spikes of 2008 seem a mere blip.

This stark warning, in line with calls from organizations such as the World Bank, the World Food Program, and Asian Development Bank (ADB), was issued by members of the Board of Trustees (BOT) of the International Rice Research Institute (IRRI) following their meeting on 16-19 September at Institute headquarters in Los Baños, Philippines.

The global community needs to remember two key things," said BOT Chair Elizabeth Woods. "First, that growth in agricultural productivity is the only way to ensure that people have access to enough affordable food. Second, that achieving this is a long-term effort. A year or two of extra funding for agricultural research is not enough. To ensure that improved technologies flow from the research and development pipeline, a sustained re-investment in agriculture is crucial."

Dr. Woods pointed out that the annual rice yield growth rate has dropped to less than 1% in recent years, compared with 2–3% during the Green Revolution period of 1967-90. Based on projected income and population growth, annual productivity growth of almost 1.5% will be needed at least until 2020.

The meeting coincided with the release of a report by the Food and Agriculture Organization of the United Nations stating that higher food prices are partly to blame for the number of hungry people growing by 75 million to around 925 million worldwide.

Higher prices have already forced the Philippine government to scale down efforts to overcome malnutrition among children. The government has cut its Food for School Program from the top 40 food-poorest provinces to the top 20. The country, which was the world's largest importer in 2007, is expecting to import around 1.5 million tons of rice in 2009.

Another ADB report, released in September, argued that, for Asian countries to prevent future food price surges, agriculture needs wide-scale structural reform and that, with demand remaining higher than supply, any supply shock would further increase cereal prices. Although the export price of rice has settled from more than US$1,000 per ton in May to around $700 per ton, it is still double the price of 1 year ago.


RICE VENDORS at a market in Manila, Philippines.

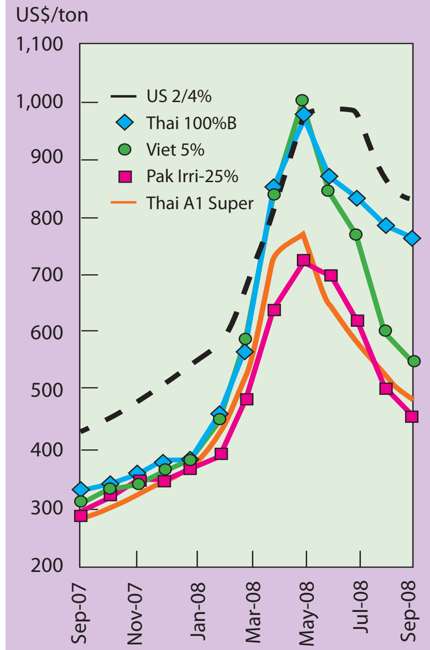
JOSE RAYMOND PANALIGAN

The higher prices, along with favorable weather, helped boost planting area and production in several countries, including India and Pakistan. India is maintaining its export restrictions on non-Basmati varieties, although there is talk of eliminating or loosening them in the coming months.

Despite a 7.4% drop in volume because of export restrictions, high prices allowed Vietnam to earn around $2.4 billion—up almost 90% from 2007—from rice exports in the first nine months of 2008. Thailand, one of the few major exporters not to impose restrictions, was on track to hit 10 million tons of exports this year. From January to 18 September, Thailand exported 8.08 million tons of rice, a 39% jump over the same period in 2007. At $4.91 billion, the value of exports was more than double that for the same period in 2007.

The current crisis serves as a timely wake-up call for governments, multilateral organizations, and donors to refocus on agriculture. Various national and international bodies have called for a second Green Revolution—one that needs to increase productivity sustainably, with ever-fewer resources—to feed the world in the face of a growing population and shrinking land base for agricultural uses.

Export prices for rice



Source: FAO Rice Price Update October 2008

Food shortages as rat plague spreads

People living in the bordering areas of India, Bangladesh, and Myanmar continue to struggle against the rat plague that is destroying their rice production. The rat population in this area explodes every 50 years or so in parallel with the flowering of a native species of bamboo, which provides food for the rodents. When the bamboo supplies are exhausted, the rats turn to the region's rice fields (for more, see Preparing for the rat race on pages 34-35 of Rice Today Vol. 6, No. 3).

KEN APLIN/CSIRO

Mizoram State in India, Chin State in Myanmar, and the Chittagong Hill Tract in Bangladesh have all been affected badly. An August report by the Chin Human Rights Organization estimates that around 200 villages are affected by severe food shortages and more than 100,000 people are in need of immediate food aid.

In Mizoram, around 150,000 families have been affected. According to the Mizoram government, the state's rice harvest was decimated, dropping from 73,600 tons in 2005 to around 8,500 tons in 2007.

The Australian Agency for International Development contributed US$400,000 in humanitarian aid to Bangladesh for the Chittagong Hill Tract through the World Food Program and the United Nations Development Program. However, it is anticipated that substantial further assistance will be required to help the affected people get back on their feet.

Major biotech event for Thailand

Ministries, government agencies, and the private sector will join forces in Thailand to stage one of Asia's largest-ever biotechnology events in Bangkok on 25-27 November 2008.

The Thailand Center of Excellence for Life Sciences, together with the National Center for Genetic Engineering and Biotechnology and exhibition organizer Pico (Thailand), will stage BioAsia 2008, a major international biotechnology conference and exhibition.

The event aims to stamp Thailand as an Asian biotechnology hub by bringing together more than 5,000 researchers, academics, investors, and commercial developers of biotechnology products at the Queen Sirikit National Convention Centre, as well as more than 40 distinguished speakers from around the world.

Dr. Juan Enriquez, the Founding Director of the Harvard Business School Life Sciences Project and author of the global bestseller As the Future Catches You, will deliver a keynote address at the event. More information is available at www.bioasiabangkok.com or by emailing info@bioasiabangkok.com.

BRIEFLY

$500,000 donation for IRRI

IRRI has received a donation of materials worth $500,000 from 5 PRIME, a Germany-based company that produces technologies and reagents for molecular biology applications. The donation includes technologies and reagents for DNA isolation, amplification, and molecular analysis and will strengthen IRRI's research capabilities in its work to achieve more efficient and cheaper rice production, including the development of drought-tolerant rice varieties. "We are very proud to support this extremely important research mission with our technologies," said 5 PRIME chief executive officer Bernd Haase. "Molecular biology is one of the keys to generating scientific advances that may not only reduce hunger in developing countries but also spark their subsequent economic growth and ultimately lift more people out of poverty."

Vietnam flood plan

The Vietnamese government plans to spend around $146 million between now and 2010 to build dikes and relocate thousands of rice farmers because of heavy seasonal flooding in its fertile Mekong River Delta. The program would help 33,000 families resettle in areas away from landslides and floods. About one-fifth of Vietnam's 86 million people live in the Cuu Long (Mekong) River Delta, which produces more than half of the country's paddy output and supplies more than 90% of its commercial rice. Funding will come from the state budget, grants, and loans from the state-run Vietnam Development Bank. Floods arrive between August and November each year in the Delta.

Yield gene discovered

A team of scientists has identified a gene that controls the size and weight of rice grains. The study, by Chinese and U.S. researchers, shows that it is possible to increase rice's yield by enhancing the expression of a particular gene. The scientists initially found strains of rice that exhibited underweight grains. In one such strain, the cause was identified as a mutation in the GIF1 gene, which is responsible for controlling the activity of invertase, an important enzyme involved in the formation of starch within developing grains of rice. If invertase is inactive, the rice plant cannot produce edible grains. Invertase activity in the mutant strain was only 17% of that in the normal strain. The team then created transgenic lines of rice in which GIF1 is overexpressed and found that, compared with normal strains, the rice had larger and heavier grains. The study was published on 28 September in an early online edition of Nature Genetics, and will be featured in the journal's November print issue.

Myanmar recovering after cyclone

Improved agricultural productivity can help developing countries reduce their reliance on emergency food relief following natural disasters. This is one of the conclusions of a team of IRRI scientists who visited cyclone-devastated Myanmar in August.

Cyclone Nargis devastated Myanmar's Ayeyarwaddy (Irrawaddy) Delta area on 2-3 May, leaving more than 140,000 people dead or missing and causing an estimated 1.2-million-ton (6%) drop in rice production, jeopardizing the country's food security and exports. In hard-hit areas closer to the coast, planted area was down 25% because of a lack of labor, infrastructure, equipment, and draft animals.

On 26 and 28 August, IRRI scientists T.P. Tuong, David Johnson, Abdelbagi Ismail, Grant Singleton, and Ruben Lampayan met in Yangon with representatives from the United Nations Development Program, the Food and Agriculture Organization, and the Myanma Agriculture Service (MAS) to discuss IRRI's role in plans to increase rice production during the coming dry-season crop and the 2009 wet-season crop. On 27 August, the team visited two townships (Kun Yangon of Yangon Division and Daedaye of Ayeyarwaddy Division) in Nargis-affected areas.

U San Nyunt, general manager of MAS Seed Division, said that the key rice needs of Myanmar are more fertilizer for high-yielding varieties and improved production of high-quality seed. The government has asked IRRI for seeds of salt-tolerant rice varieties, and the MAS Seed Division needs equipment to monitor salinity levels in farmers' fields and on seed farms.

Salt-tolerant high-yielding varieties will be important, particularly to replace the low-yielding varieties being grown in coastal areas. IRRI plans to provide some of its more than 800 salt-tolerant breeding lines for testing by MAS.

GRANT SINGLETON

A FARMER shows the height of the Cyclone Nargis tidal surge.

IRRI, through the Irrigated Rice Research Consortium and the Consortium for Unfavorable Rice Environments, will provide guidance on best-management options. The Institute also plans to support Myanmar's work to improve seed storage and can help farmers save irrigation fuel costs through the use of water-saving technologies.

"A disaster of Nargis's scale will hurt any country," said Dr. Tuong, "but a robust and efficient agricultural sector helps people get back on their feet faster and with less need for emergency aid."

Rice in blood pressure?

Scientists from Tokyo University have developed transgenic rice plants with high levels of nicotianamine (NA), a substance that inhibits the function of a key enzyme involved in hypertension (high blood pressure). Inhibition of angiotensin I-converting enzyme (ACE) leads to reduced hypertension, the leading cause of cardiovascular disease and cerebral stroke, affecting around 1 billion individuals worldwide. The scientists found that NA derived from the transgenic rice strongly inhibited ACE activity, even compared with commercially available antihypertensive medicine. The work appears in the September 2008 issue of Plant biotechnology journal.

New zinc test

A new zinc fertilizer test kit enables buyers, distributors, and researchers to evaluate the purity of their zinc fertilizer prior to field use. Launched in the Philippines on 12 August by Philippine Department of Agriculture Secretary Arthur Yap, the kit has potential across Asia, where zinc deficiency is an increasingly important problem in rice production. The kit, developed by IRRI scientists Jack Jacob and Sarah Beebout, provides a rapid color-chart-based test to determine the zinc content of zinc sulfate fertilizer, without the need for a laboratory or electricity.

2,300-year-old rice

A pot of rice has been recovered from a soil layer believed to belong to the 3rd century BC from the archaeological site in Tissamaharamaya, Sri Lanka. The soil layer, 4.5 meters below the surface, recently yielded ruins of a residential complex of noblemen. Tissamaharamaya is believed to have been the capital of the Magama Kingdom in Ruhuna, and Akurugoda, the site of the excavations, is believed to be the inner city of the kingdom. Excavations are conducted jointly by the Sri Lankan Archaeological Department and the Archaeological Institute of Germany.

Terraces lose development fund

The Philippine Department of Tourism (DOT) has turned down a plan to develop the Ifugao rice terraces. A $930,000 proposal to develop a tourist village in the area was not included in the proposed 2009 budget because it would push the department beyond its budget ceiling for next year. The DOT had proposed the purchase of 25 hectares of rice terraces for the village. Many farmers were no longer tending their terraces because doing so is no longer economically viable. The United Nations Educational, Scientific and Cultural Organization (UNESCO) has included the rice terraces on its list of world heritage sites since 1995.

BRIEFLY

Boost for troubled farmers

The Food and Agriculture Organization of the United Nations (FAO) will provide $500,000 to increase rice production in conflict- and flood-affected districts of Sri Lanka. The project Input supply to vulnerable populations under Initiative on Soaring Food Prices has been funded in response to a request by the Sri Lankan government for assistance in combating the soaring food prices. FAO will provide funds to renovate 6,000 hectares of former rice land and distribute seed to the farmers in the problem areas. Six hundred metric tons of certified seed will be distributed to the target families in collaboration with the Department of Agriculture in Batticaloa, Ampara, Polonnaruwa, and Anuradhapura districts.

IRRI memorial fund

The Asia Rice Foundation USA has established an IRRI memorial fund to memorialize with a donation in their names former IRRI staff members who have passed away. The Foundation established the fund in 2005. Half of the income is used for a program to support young scholars involved in rice research. The other half is invested to grow an endowment fund for long-term support of rice research. Donations through July 2008 total $12,500. The U.S. Internal Revenue Service has given Asia Rice Foundation USA, Inc. nonprofit status and all donations are tax-deductible. Donations can be sent to Hugh Murphy at Asia Rice Foundation USA, Inc., 150 Kala Heights Drive, Port Townsend, WA 98368, USA; email h.murphy@cgiar.org.

Of all the people...

Of all the people in all the world is an exhibition that uses grains of rice to bring abstract statistics to life in a startling way. According to the exhibitors, "Each grain of rice equals one person and you are invited to compare the one grain that is you to the millions that are not." Over a period of days, a team of performers carefully weighs out quantities of rice to represent a host of human statistics, including populations of towns and cities; global or regional numbers of doctors versus numbers of soldiers; the number of people who are born and who die each day; and the number of people who die in disasters and warfare. The statistics, which are arranged in labeled piles that form an ever-changing landscape of rice, "can be moving, shocking, celebratory, witty, and thought-provoking." For more information on the UK exhibition, see www.stanscafe.co.uk/ofallthepeople.

Less water = less arsenic

Rice grown "aerobically" in unflooded fields (like wheat and maize) accumulates less arsenic than rice grown in puddled conditions, according to a study by a team of UK and Chinese researchers. In several countries, including Bangladesh and India, rice is a major source of human exposure to arsenic, which has been linked to cancer and other diseases. The problem occurs when farmers flood rice paddies with arsenic-contaminated irrigation water. The scientists compared rice plants grown in flooded soil in greenhouse conditions with rice plants grown under aerobic conditions—a technique developed initially to conserve water. The aerobically grown rice's arsenic level was 10 to 15 times lower than that of flooded rice. Their study was published in the 1 August issue of the American Chemical Society's *Environmental science & technology* journal.

Letter

Dear Executive Editor,

My respects to you all. I am writing to Rice Today because I will give its articles and those of RIPPLE to some low-price journals and magazines from a private media group. I will distribute interesting articles on rice production development and rice science for media groups and some public libraries free of charge as a general volunteer worker. I am a low-income person. I do various personal work, part-time nonprofit work, and charitable work.

I will use those articles for interested persons from various sections. … I really hope that many farmers or persons interested in farming will obtain some general knowledge in local language, Myanmar, after I distribute articles about rice science and rice production. I have been aware that natural disasters happened in the Philippines and around the world. Please pray for all people who died from these natural disasters and all the rest who survived around the world, including those in Myanmar.

With best wishes, yours respectfully,
Mr. Than Htaik (a) Manan

TRAINING COURSES AT IRRI

Leadership Course for Asian Women in Agriculture R&D and Extension

IRRI Training Center, Los Baños, Philippines, 2–13 March 2009

Topics include Asian women in the workplace; mainstreaming gender concerns in the workplace; leadership and management; personality development; developing work-related knowledge and skills; and relating to others.
For more details, contact Dr. Thelma Paris (t.paris@cgiar.org) or Dr. Noel Magor (IRRITraining@cgiar.org).

Ecological management of rodents, weeds, and rice diseases—biological and social dimensions

IRRI Training Center, Los Baños, Philippines, 16–27 March 2009

The themes for the course are ecologically-based pest management with an emphasis on rodents and weeds; applying social science knowledge in decision analysis of pest and disease problems; farmer participatory research. Presenters at the course include Emeritus Professor Charles Krebs, Dr. Grant Singleton, Dr. David Johnson, Dr. Serge Savary, Dr. Flor Palis, and Dr. K.L. Heong.
For more details, contact Dr. Grant Singleton (g.singleton@cgiar.org).

RiceToday around the world

TERRY JACOBSEN, IRRI head of operations, admonishes some Italians who didn't eat their rice. The *Chiesa dei Morti* (Church of the Dead), in Urbania, Italy, has been home to 18 mummies since 1833. The bodies were naturally preserved by a mold that absorbed the corpses' moisture.

GREAT WALL of rice: IRRI crop physiologist Tanguy Lafarge and sons Nathan (*left*) and Rèmi take the magazine to China.

EYES ON the rice: former IRRI scientist Rhulyx Mendoza about to score yet another goal for *Rice Today*.

THE CITY of love becomes, at last, the city of rice. IRRI scientific editor Tess Rola with *Rice Today* in front of the Eiffel Tower in Paris.

Keeping up with IRRI staff

Graham McLaren, who headed the IRRI-International Maize and Wheat Improvement Center (CIMMYT) Crop Research Informatics Laboratory (CRIL) from its formation in 2006, has left the Institute to head the Generation Challenge Program, which harnesses molecular biology and crop genetic resources to develop plants that meet farmers' needs. Dr. McLaren will be based at CIMMYT headquarters in Mexico. **Thomas Metz** becomes interim head of CRIL.

Plant biotechnologist **Inez Slamet-Loedin** joined the Institute on 4 August. Her duties will include the development of transgenic products carrying agronomically important genes and validation of the function of candidate genes. **Kyung-Ho Kang**, senior scientist (plant breeding), joined IRRI on 11 August to work under the project "Germplasm Utilization for Value Added." Molecular biologist **Ajay Kohli** started at IRRI on 29 September. His duties include dissecting genetic pathways for key agronomic traits and applying genomics tools to validate gene function. Entomologist **Finbarr Horgan** is scheduled to arrive at the Institute in October. His duties include the development of strategies to integrate plant resistance with natural biological control and crop management practices to enhance sustainable pest management. **Fiona Farrell**, new head of IRRI's Human Resource Services, arrived in September. She replaced acting head **Paramjit Sachdeva**.

Devendra Gauchan and **H.N. Singh** have been appointed as postdoctoral fellows under the Bill & Melinda Gates Foundation project on stress-tolerant rice. Dr. Gauchan, based at IRRI's Philippine headquarters, will conduct socioeconomic research, including analysis of livelihood systems of farmers in stress-prone rainfed (nonirrigated) environments. Dr. Singh, based in India, will provide technical and logistical support in the planning, design, coordination, and implementation of farmer participatory research.

D.C. Bhandari, lead coordinator at the IRRI-India Office in New Delhi, departed the Institute on 1 August to return to the National Bureau of Plant Genetic Resources as principal scientist and head. **Vijay Kumar**, previously executive secretary at India's National Academy of Agricultural Sciences, takes over from Dr. Bhandari.


NICOLAS RATZENBOEK/SDC

ACHIM DOBERMANN, IRRI deputy director general for research (*left*), demonstrates a drum seeder at the 2008 Annual Development Cooperation Conference of the Swiss Agency for Development and Cooperation (SDC), held on 22 August in Fribourg, Switzerland. This year's conference focused on the Mekong Region, around the themes of food security and sustainable globalization. IRRI's exhibit included the drum seeder, a grain quality kit, the rice "super bag," a leaf color chart, and a collection of diverse rice varieties.

Moving on

Former IRRI photographer (1961-89) **Urbito ("Bito") Ongleo** passed away on 6 September in Los Baños, Philippines, at age 74. His most famous photo (*below*) showed U.S. President Lyndon Johnson in a plot of Green Revolution rice variety IR8 with Dr. Robert Chandler, Philippine President Ferdinand Marcos, and IRRI breeders Peter Jennings and Hank Beachell.


URBITO ONGLEO

University of Minnesota Regents Professor Emeritus **Vernon Ruttan** died on 18 August from a brief illness, aged 84. Professor Ruttan worked at IRRI as an agricultural economist in 1963-65.

Statistician **K.M. Palaniswamy**, an IRRI scholar in 1968-70, died tragically in a road accident on 5 December 2007. He was working on a book titled Guidelines for Rice researchers in the estimation of some plant parameters, to which his daughter, **Usha Rani Palaniswamy**, contributed, and hopes to complete soon.

Partners in progress

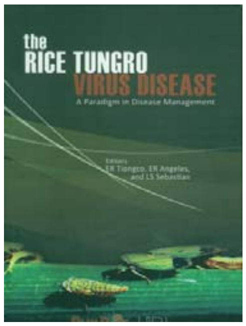
Thomas Rosswall has been selected as chair of the CGIAR Challenge Program on Climate Change, Agriculture, and Food Security. Professor Rosswall, a microbial ecologist and ecosystem scientist with extensive research experience in agriculture and climate change, is currently executive director of the International Council for Science.

Parashuram Lal Karna has been appointed acting executive director of the Nepal Agricultural Research Council. He replaces **Nanda P. Shrestha**, who retired on 3 July.

The rice tungro virus disease: a paradigm in disease management

Edited by E.R. Tiongco, E.R. Angeles, and L.S. Sebastian; published by the Philippine Rice Research Institute (PhilRice); Philippines P1,000, developed countries US$60, developing countries $30. Shipping and Handling costs: Philippines: P120 to P150 (via post or fast courier), international (depending on zones): $25 to $65.

This book highlights the most important rice virus disease in tropical Asia. Although much is known about tungro, it remains a major threat, lowering production by up to 80% in severe cases. Twelve chapters, written by expert rice scientists, pathologists, and economists, contain comprehensive information on tungro, including virus pathology, transgenic resistance to tungro viruses, and improved tungro management approaches. For orders, email prri@philrice.gov.ph. Make checks or postal moneys order payable to the Philippine Rice Research Institute.



Appreciating Rice

A.S. Roque; published by PhilRice.

This book contains a wealth of knowledge sourced from the Philippine Rice Research Institute, the International Rice Research Institute, and various rice-industry experts and practitioners. The author, an educator-journalist, wrote the book in an easy-to-understand style for people with little experience in the rice production process—growing, harvesting, postharvest, and more—from field to the dining table. For orders, email prri@philrice.gov.ph.

Popong eats his rice

C.G. Ocampo with illustrations by G. Dy; published by the Philippine Bureau of Agricultural Research (BAR); 34 pages.

The book narrates the story of a child, Popong, and his Wizard-of-Oz-like adventure with the Rice Prince in the world of rice. The Rice Prince, who appeared in Popong's dream, teaches the boy important lessons about eating rice and not wasting it. In the words of a schoolteacher who used the book with her second-grade students, "This children's story book is very useful because the words used are simple and the illustrations are clear and very colorful. They make the difficult task of explaining how rice is grown entertaining and fun." To order, contact BAR on +63 2 926 2538.

RECIPE

Adapted from the New York Times

Hainanese chicken rice

Serves 4–6
Time: 1½ hours, plus resting

A classic Singaporean/Malay dish developed by immigrants from the southern Chinese island of Hainan.


HTTP://FLICKR.COM/PHOTOS/JETALONE

Ingredients

Chicken and rice
Salt and freshly ground pepper
1 whole (1.4–1.8 kg) chicken (trim excess fat)
3–4 cloves smashed garlic
1 teaspoon minced garlic
3–4 slices fresh ginger
1/4 cup peanut (or corn or canola) oil
3 shallots or 1 small onion, roughly chopped
2 cups long-grain rice
1/4 cup minced spring onions (scallions)
2 cucumbers, peeled and sliced
Chopped fresh cilantro (coriander) leaves

Chili-garlic sauce: 5 fresh red chilies; 2-cm chunk of ginger; 3 garlic cloves; 1/4 teaspoon salt; 1 teaspoon lime juice; 2 tablespoons chicken stock (from the boiled chicken)

Ginger sauce: 75 grams ginger; 6 garlic cloves; 1/2 teaspoon salt; 1 teaspoon lime juice; 2 tablespoons chicken stock (from the boiled chicken)

Sauce for chicken: 1 tablespoon garlic oil; 1 teaspoon sesame oil; 5 tablespoons light soy sauce; 1½ tablespoons sugar (to taste); 3 tablespoons chicken broth (from boiled chicken)

Preparation

Chicken and rice
Bring a large pot of water to a boil and salt it. Add chicken to pot (completely submerge) along with smashed garlic and sliced ginger. Cover, reduce heat to medium, and cook for 10 minutes. Turn off heat and let chicken remain in water, covered, for 45–60 minutes or until it is cooked through.

Remove chicken from pot (keep the stock) and let it cool to room temperature. Put the peanut oil in a frying pan over medium heat (add trimmed chicken fat if desired). When oil is hot, add shallots and remaining garlic. Cook for about 5 minutes, stirring occasionally, until lightly browned. Add rice and stir until glossy. Add 4 cups of the chicken stock and bring to a boil, then reduce heat to low and cover. Cook for about 20 minutes, until rice has absorbed all the liquid. Add salt and pepper to taste.

Chili-garlic and ginger sauces: add all ingredients into a blender, and mix until ingredients are well blended. Add salt or sugar to taste.

To serve
Chop chicken (keep or discard skin, as preferred). Put chicken and rice on plates and garnish with cucumbers, remaining spring onions, and cilantro. Combine ingredients for the chicken sauce and drizzle over the chicken. Serve with sauces and a bowl of the remaining stock.

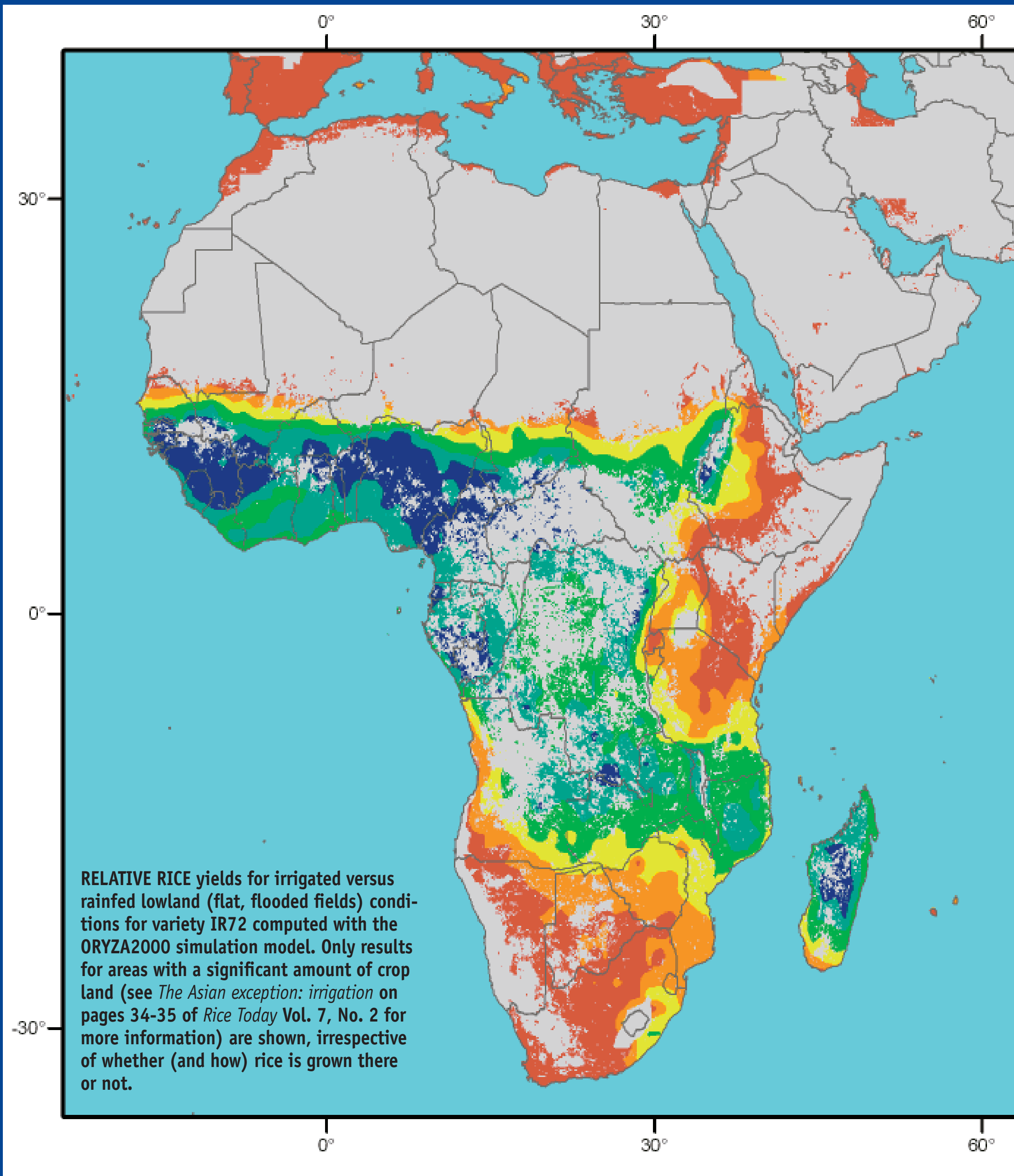
Simulating water stress

by **Robert Hijmans**

Prioritization of agricultural technology development—such as breeding for new varieties—should, among other things, be based on expectations about the adoption of the technology by farmers, and on the consequential economic and environmental benefits. That is easier said than done. A major obstacle to estimating adoption and benefits is that the value of agricultural technologies is location-specific. That is, their utility can depend strongly on spatially variable environmental factors, such as soil type and climate, and social and economic circumstances.

The effect of environmental variability on crop growth can to some extent be estimated with crop growth models. Such models encapsulate knowledge of eco-physiological processes and allow simulation of crop yield for specific varieties and locations. In this way, complex location data, such as daily weather data, can be summarized with an easy-to-interpret index such as crop yield.

The map shows the yield of rice grown in lowland conditions (flat, flooded fields) without irrigation relative to yield with full irrigation (we refer to this as the "relative yield"), as computed with the ORYZA2000 simulation model.[1] For example, in red areas, rice grown without irrigation would achieve less than 15% of the yield expected



RELATIVE RICE yields for irrigated versus rainfed lowland (flat, flooded fields) conditions for variety IR72 computed with the ORYZA2000 simulation model. Only results for areas with a significant amount of crop land (see ***The Asian exception: irrigation*** **on pages 34-35 of** ***Rice Today*** **Vol. 7, No. 2 for more information) are shown, irrespective of whether (and how) rice is grown there or not.**

[1] Bouman BAM, Kropff MJ, Tuong TP, Wopereis MCS, ten Berge HFM, van Laar HH. 2003. ORYZA2000: modeling lowland rice. IRRI. Available at www.knowledgebank.irri.org/oryza2000.

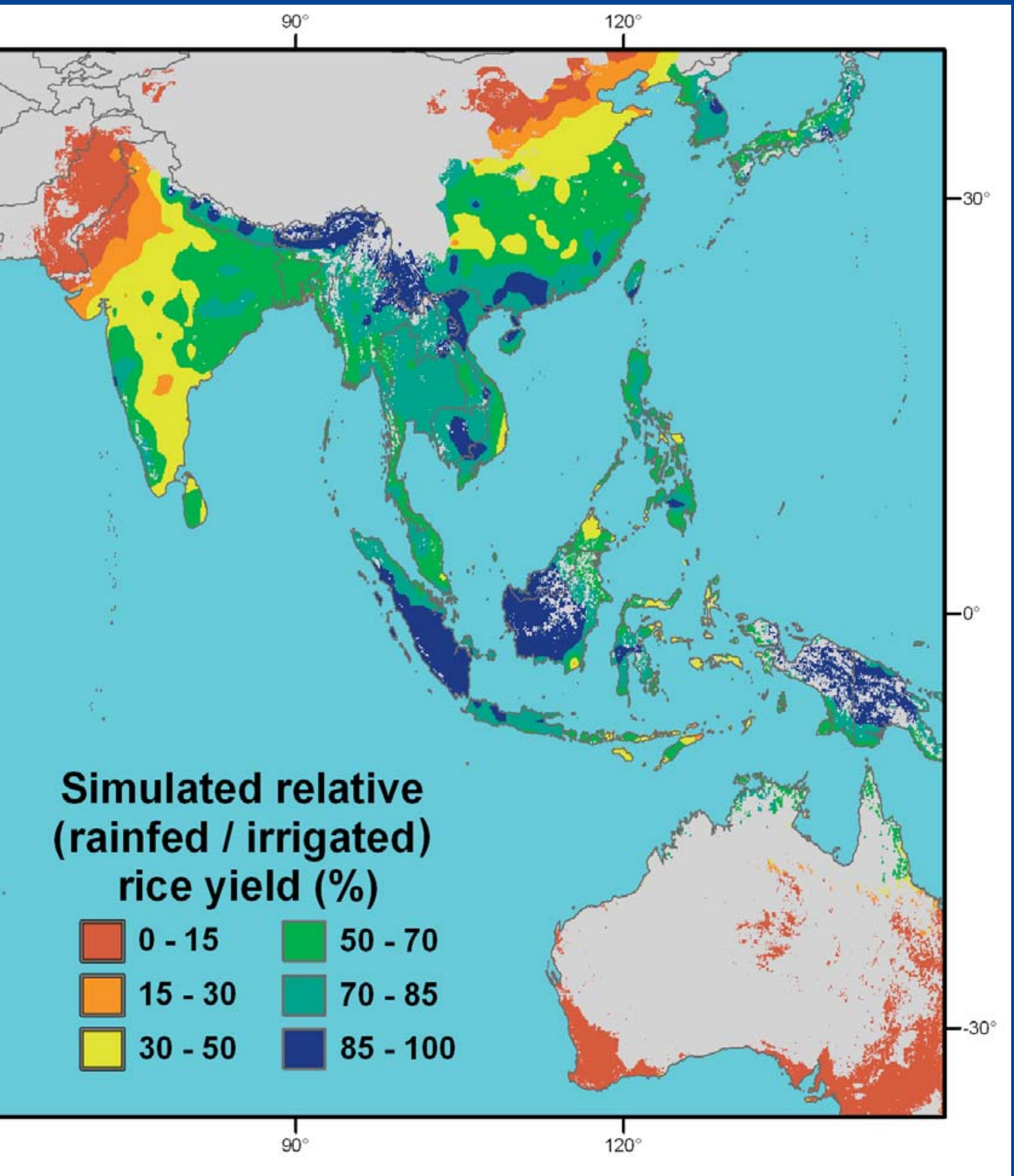
with irrigation. It is a highly stylized example that shows simulation results for only one variety (IR72). It used 9 years of daily weather data[2] to compute average and relative yields (with and without irrigation) over this period. Many other known sources of variation, such as local hydrological processes and differences in soil types, are not taken into account in this example.

It nevertheless shows some basic facts about rice and water. There are some places where you cannot grow much rice without irrigation. This does not necessarily mean that water stress is an important problem there. In fact, some of the most productive rice areas are found there, including the Punjab in India and the Nile Valley in Egypt. On the other hand, if water becomes scarce in these regions—as is happening in many areas—water-saving irrigation technologies and appropriate varieties would be very useful.

Most areas with a relative rice yield of below 50% have little rainfed (nonirrigated) rice production.[3] But this does not mean there is no irrigated rice in wetter areas where farmers could produce a reasonable rice crop without irrigation. For example, in southeastern China, farmers could produce rice without irrigation. However, supplemental irrigation increases production, particularly in dry years, and allows for the production of rice or another crop outside the main rainy season.

The map shows the relation between maximum rainfed yield (in the rainy season) and yield of irrigated rice in the off-season (any season that would allow the highest yield if irrigation were available). It therefore reflects a yield increase partly by reduced water stress and partly by shifting toward growing seasons with more solar radiation and perhaps lower temperatures.

Drought tolerance would seem particularly relevant in areas with predominant rainfed production with a moderate to large yield reduction (50–70% relative yield). Such areas include Bangladesh and eastern India. Current research[4] aims to refine the approach by improving the data used to run the models, and by running models for different rice ecosystems and for different varieties to contrast existing versus new drought-tolerant varieties, and to contrast current cropping practices versus water-saving technologies.



Dr. Hijmans is a geographer in the IRRI Social Sciences Division.

[2] Estimated from satellite observations by NASA, data available at http://earth-www.larc.nasa.gov/cgi-bin/cgiwrap/solar/agro.cgi.

[3] Compare this map with the rice area by ecosystem map on pages 20-21 of *Rice Today* Vol. 6, No. 3 (www.irri.org/publications/today/pdfs/6-3/20-21.pdf).

[4] Together with colleagues at the International Food Policy Research Institute and the University of Minnesota, see www.harvestchoice.org.

A FLOUR BLOOMS

by **Masaru Yamada** and **Satomi Tamai** in Tokyo


STARBUCKS COFFEE JAPAN

Rice flour-based products are booming in Japan, forcing the country to change the way it thinks about agriculture

Yuko Kimura, a chef at Fukusoen, a traditional noodle restaurant in Tsuruoka City in Yamagata Prefecture, is riding the crest of a wave. After launching the "Haenuki Men" rice noodle in June 2007, Fukusoen, owned by a local agricultural cooperative known as JA, sold 18,000 of the meals by the end of March 2008. Then, from April to June 2008, the restaurant sold almost the same amount again.

Instead of soba, the traditional buckwheat used for noodles, rice flour is the main ingredient of Haenuki Men noodles. By adding some starch from a domestic potato, says Kimura, "We could develop a noodle with a great texture that isn't available with traditional soba."

With rice-flour noodles gaining popularity, rice consumption in Japan has increased. The amount of rice destined for noodles is overtaking that used for breads. Rice flour began to be used for breads about 5 years ago as part of a Japanese school lunch program developed to encourage the use of locally produced food, including vegetables and rice. With local government support, more than 8,000 schools—one-third of all lunch-serving schools in Japan—serve rice-flour breads now.

YAMAZAKI BAKERY

A NEW rice-flour product launched by Yamazaki Bakery company, the biggest bread maker in Japan.

And the trend is not limited to the public sector, with an increasing number of private companies also interested in rice flour.

Lawson, a company that owns 24-hour convenience stores, announced earlier this year that they would begin to sell rice-flour breads at around 8,500 shops from September. In Japan, the new demand for products such as those made from rice flour is currently responsible for the consumption of around 6,000 tons of rice per year. It is believed that Lawson's contribution alone will more than double this figure.

Yamazaki Bakery, a major baking company that also sells rice-flour breads, has expanded its market to the whole of Japan, selling about 50,000 loaves of rice-flour bread per month. According to a Yamazaki representative, "The novelty of using rice flour and the use of local rice appeal to consumers. We plan to offer a range of rice-flour breads."

Improvements in milling technology are extending the advantages of rice flour. The finer it is milled, the "stickier" rice flour becomes—a property that gels with consumer tastes. In this light, Starbucks Coffee Japan began offering rice-flour rolls in June.


MASARU YAMADA

A NEW RICE noodle product, which won a prize in the national food contest held by the agricultural ministry in 2007.

"The sticky taste goes with coffee very well," says a Starbucks spokesperson. "And, because wheat has become much more expensive, the price difference between wheat and rice flour has dwindled."

This point underlies the fact that Japan, which is self-sufficient in rice but must import much of its wheat, was not directly affected by the rice-price spike in 2008.

Rice flour itself is not new to Japan, which has a history of thousands of years of rice production. However, breads, noodles, cakes, and many other products previously thought to require wheat as a main ingredient are now being made from rice flour—and they are gaining great favor in Japan.

So, what are the reasons?

STARBUCKS COFFEE Japan, Ltd., is now making rolls with 100% rice flour.

First, skyrocketing international grain prices have made Japanese rice, which is segregated from the international market by high tariffs, more competitive. Second, recent scandals with many imported food items have prompted Japanese consumers to seek more locally grown food, which is seen as safe and tasty.

Another advantage of rice flour is that it isn't always necessary to add gluten, which can cause allergies. Although products such as bread, which uses rough rice flour, require gluten, products such as cakes and cookies, which use finer rice flour, do not. So, even people who are allergic to flour can eat rice-flour cakes and cookies without anxiety.

Awareness of rice-flour products is growing fast. In 2003, less than 7% of Japanese consumers knew of rice-flour bread; in 2006, the number jumped to 44%.

Although it is becoming smaller, there remains a huge gap between Japan's domestic rice prices and international prices. The Japanese government is, however, trying to close that gap. For instance, the government has given away free rice to companies that try to develop new rice-based food.

With Japan only 40% self-sufficient in food (on a caloric basis), the Japanese government is encouraging farmers to produce more rice for these new purposes, because eating more domestically grown rice in any form boosts the self-sufficiency ratio.

In the 1960s, Japan's average per-capita rice consumption was 118 kilograms. Now, the average Japanese citizen eats less than 60 kilograms. This long-term trend causes problems for Japanese agriculture. Around 40% of the country's rice fields are kept fallow to maintain the supply-demand situation. Nearly 10% of farmland in Japan is now abandoned, with lack of labor being one of the main reasons. Even though farmers are eligible for a subsidy if they set aside rice production and produce other crops, some simply give up their land because alternative crops usually require more skilled labor.

Rapidly growing demand for rice flour therefore looms as a golden opportunity to fix some of the problems faced by Japan's farming communities.

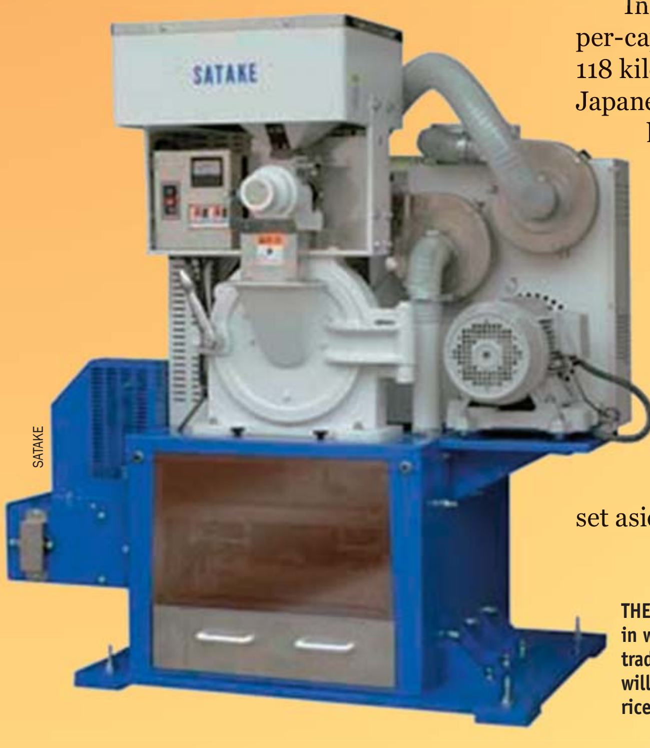
But farmers in Japan have not been so enthusiastic. Selling rice as a traditional staple is much more attractive than selling it for the new demands. Traditional buyers pay substantially more than newcomers do, although farmers are eligible for a subsidy to compensate for this.

LAWSON

MANY DIFFERENT types of rice-flour bread—available at Lawson 24-hour convenience stores—have increased consumers' awareness of rice flour.

To beef up rice production, new measures taken by the government are directly aiding farmers who grow rice for new uses. More aid will be paid to such farmers than to those growing other crops in idle paddy fields. Farmers growing rice for rice flour and livestock feed will receive 500,000 yen (US$4,800) per hectare per year. This is 30% higher than the amount of aid awarded to farmers who grow soybeans and wheat, for example. The government hopes that this will provide sufficient incentive to grow rice for flour.

One of the most important lessons from recent years is the value of innovative thinking. For a long time, the Japanese rice industry did not develop alternative rice flour–based products because it thought rice should be eaten only as a traditional staple. Now, though, it is clear that more consumers want to eat less conventional items. And, the industry is jumping at the chance.



SATAKE

THE COMPACT MILL (0.7 m in length by 1.1 m in width by 1.4 m in height) made by Satake, a traditional maker of grain-milling equipment, will help small bakeries and farmers to produce rice-flour products.

Mr. Yamada and Ms. Tamai are journalists based at The Japan Agricultural News, Japan's largest agricultural newspaper.

Conducted by Gene Hettel

JERBY AGUIHON (3)

Figures, fake guns, and fund-raising

For 25 years from July 1967, Thailand's Kwanchai Gomez was the International Rice Research Institute's chief statistician. She was also IRRI's first female international scientist in what was then a very male-dominated field. In 1993, Dr. Gomez moved out of statistics to work on donor relations as the head of the new Liaison, Coordination, and Planning Unit, which focused on an innovative experiment at the time: fund-raising. She returned to Thailand in December 1996 to spend 2 years at IRRI's Bangkok office and round off more than 3 decades with the Institute. Dr. Gomez, who remains in Bangkok, is currently executive director of the Asia Rice Foundation, which is based in IRRI's Philippine hometown of Los Baños

A new bride with a statistics degree

How did I get to IRRI? By marrying, in April 1967, a Filipino, Arturo A. Gomez [who was professor of agronomy at the University of the Philippines at Los Baños]. I had earned a PhD in statistics from North Carolina State University, the place where I met my future husband. After our wedding in Bangkok, I decided to resign from my teaching job at Chulalongkorn University and move to Los Baños to be with my husband. I hoped to find a job there instead of in Manila because going to Manila every day back then would have been horrible because of the terrible roads. Luckily, Burton Oñate, who was then chief statistician and head of the Statistics Department at IRRI, was going to take sabbatical leave at the Asian Development Bank in Manila for 1 year.

So, he heard about this new bride with a degree in statistics who was nearby. He contacted me and suggested I apply to be his "temporary" replacement. Bob Chandler [IRRI Director General, 1960-72] and Colin McClung [IRRI assistant director (1964-66) and associate director (1967-71)] interviewed and hired me and the rest is history.

As a statistician at a research institute like IRRI, my goal was to see that all rice researchers, be they in the field or laboratory, used the proper statistical techniques and procedures. To my surprise when I came, statistics—be it experimental designs or statistical analyses—were not appreciated, understood, or used very much in any of IRRI's experiments. That was a challenge for a very young person like me, a woman—the only lady scientist for a long, long time at IRRI, not to mention being an Asian from Thailand. It was difficult working with these very renowned, relatively older, scientists and telling them that they ought to be using statistics in their experiments.

IRRI

DR. GOMEZ at IRRI in the 1960s

Things changed for the better when I talked to Hank Beachell, then the chief plant breeder [and eventual World Food Prize winner in 1996]. I thought, if I could convince him, maybe I could convince the others as well. So, I asked him why he was not using statistics in his yield trials. He looked at me and said, "What do you statisticians know about field experiments and the problems we breeders face every day? You guys sit in your air-conditioned room and expect to tell us what to do in the field." I was taken aback, but not angry. I thought about this overnight.

A good perspective

The next day, I went to Beachell and thanked him profusely for having given me a very good perspective. Maybe I could win him and the others over about using statistics if I conducted my own field experiments.

Now, I didn't know anything about field experiments. I didn't know much about rice research to start with. When Chandler and McClung interviewed me, they asked me two questions: "What experience do you have with rice research and what knowledge do you have about rice?" I said the closest I ever got to a rice plant was when I was traveling from Bangkok to

Ayutthaya, in the Central Plain of Thailand, and I saw the rice plants along the road as the car passed by, and that I also knew nothing about rice research. I thought that would be the end of the interview, but it continued and they hired me anyway!

I went to Bob Chandler and asked him for some resources to conduct field experiments because until then the Statistics Department had never done any field experiments and thus no resources were available. Chandler said: “Take whatever you need; I am pleased that you’re going out to the field.” He said this because, at the time, our chief world-renowned soil scientist, Felix Ponnamperuma [IRRI’s first soil chemist, 1961-85], only worked in the lab. Chandler had tried to push him out to the field but he never succeeded. So, after I started conducting experiments, he went to Ponnamperuma and said, “If Kwanchai can go to the field, so can you.” It worked. Ponnamperuma did go out and conducted field experiments after that.

I learned a lot by conducting field experiments. S.K. De Datta [IRRI agronomist, 1964-91], my mentor and teacher, taught me everything I needed to know about conducting rice field experiments. I have always been grateful to him for that. After that, I was able to talk to the researchers much more easily and was able to convince them of the need to use proper statistical procedures in their experiments. I probably was the first statistician anywhere who conducted field experiments to get closer to the scientists.

Helping behind the scenes

There are certain professions that may be doomed to be behind the scenes. Statistics is one of those. We were used to it and we did not mind it very much. We took pride in seeing researchers using proper statistical procedures in their research. I appreciate the comments of Ronnie Coffman [IRRI plant breeder, 1971-81], which affirm that the use of statistics at IRRI has really helped the scientists.

Regarding Coffman’s comment about the statistics situation before 1971, that the yield trials were not replicated [*see box, below left*], I must defend Beachell. Actually, he was right. In those days, he really did not need statistics for his yield trials. In the late 1960s, some of the new varieties were yielding 8–9 tons [per hectare] while the traditional ones were yielding 1–2 tons. For that kind of difference, you can see it with your eyes! You did not need statistics to prove it.

Of course, those were the good old days of Hank Beachell. Such large yield differences did not last long. So, as time passed, researchers had to start looking for smaller differences—3, 2, and even 1 ton per hectare. For that, statistics were needed to detect differences that were becoming smaller and smaller. Researchers required more precision in making measurements, and in controlling experimental errors so that small differences could be detected.

IRRI researchers began recognizing the importance of statistics not only because I went to the field to conduct experiments but also because the situation had changed. Statistics became a hit because the researchers knew they could not detect those smaller differences scientifically by themselves. So, they came

On Kwanchai Gomez and the importance of statistical analysis


GENE HETTEL

Nyle Brady, IRRI director general (1973-81), in his pioneer interview: “Kwanchai Gomez was a great organizer. For the Genetic Evaluation and Utilization (GEU) Program, she was the one who kept the records of what was going on. I remember going to meetings during which she said: ‘Now you guys I know have been doing some studies to determine resistance to various insects and diseases, but I don’t have any records of what you’ve done. I can’t write it up if you don’t tell me about it.’ So she got on their backs and she was remarkable in that way.”

Ronnie Coffman, plant breeder (1971-81), said: “If I had to identify the person most responsible for the development of IR36 [at one time the most widely planted rice variety in the world], it would probably be Kwanchai Gomez. She designed the sensitive, quadruple-lattice yield trials that caused us to notice it. IR36 was an open plant type, not very attractive to the eye. Prior to the establishment of those yield trials, we would have almost certainly thrown it away. Prior to 1971, the IRRI breeding program did not replicate its yield trials, much to the chagrin of Kwanchai.”


GENE HETTEL

Graham McLaren, Dr. Gomez’s successor as chief statistician and head of the IRRI Biometrics Unit and its various incarnations (1993-2008), said, “It was the GEU that allowed the introduction of new methodologies. Today, it’s difficult to find opportunities to introduce new methodologies and that’s a frustration. Teaching statistics and bioinformatics is a challenge as well. There is huge demand for training in this area, but it is also a very difficult topic to teach and to keep people’s attention so they grasp the principles without getting bogged down in the detail.”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knocking at my door. We became quite popular because the scientists needed us. When they first arrived in my office, they would say apologetically, "Oh, by the way, we don't know anything about statistics." And I would say, "Oh, but I don't know anything about your field of discipline either, so let's talk."

I want to reiterate that the negligible application of statistics in the early years of IRRI was not anybody's fault. But I appreciate the remarks of Coffman and Brady [see box]. Of course, the Genetic Evaluation and Utilization (GEU) Program was Brady's baby. He created it and I only helped him organize it. The GEU was truly multidisciplinary. The scientists of different disciplines were not used to working together. They argued a lot, but that was okay. It was never a personal thing. I enjoyed those years. It was not easy, but it was fun. We made the GEU a success and a lot of good rice varieties—like IR36—came out of it.

Applying statistics worldwide

My goal as a statistician was to get statistics applied in rice experiments—not only at IRRI but throughout Asia and the rest of the world. I think that, in my small way, I achieved that. IRRI became a user of statistics. During those years, it became the model. National program researchers came and saw what IRRI was doing in the area. Of course, they followed and put statistics to use in their rice experiments as well.

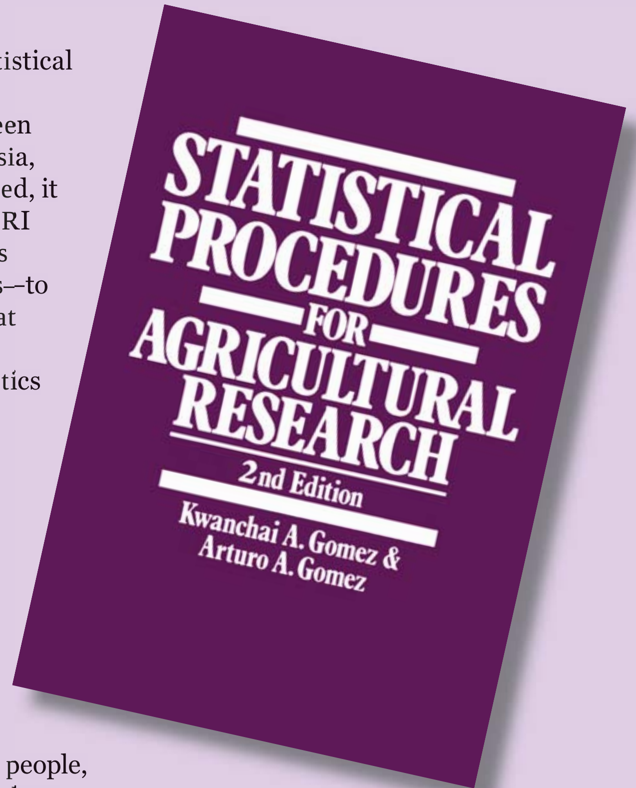
We had many nondegree training programs in those years. Statistics became a key course in those programs, accounting for 2–4 hours to 20–30 hours per course. I think that helped our cause greatly—for many years, everybody who passed through IRRI for training learned something about statistical applications in rice research. So, when they went back home, they were able to apply the concepts.

I must thank IRRI for enabling me to do two things that I believe helped greatly in my efforts. One is that, while on sabbatical leave at Stanford University, I wrote a book with my husband [Statistical Procedures for Agricultural Research]. That book has been read and used not only in Asia, but all over the world. [Indeed, it is the most popular book IRRI has ever produced.] This has been one of my greatest joys—to produce an effective tool that can help achieve my goal of teaching people about statistics whether they are students or working scientists.

The book was written 32 years ago, updated a bit in a 1984 second edition published by Wiley, and is still available. In those days, desktop computers were not accessible to everybody, so I put in the book all the statistical calculations in detail. Many people, especially statisticians, asked me why I had to detail each and every statistical analysis, step by step. My reply: if you use a computer, suddenly the answer comes out. You don't know what went on because the program did it for you automatically. My detailed explanation in the book helps researchers to understand why and how a certain statistical analysis was computed. This would help them to understand how to interpret the results better as well.

The second thing that IRRI enabled me to do was to develop a statistical computer package called IRRISTAT and make it free to everyone who needed it. IRRISTAT became one of the most widely used statistical packages available in Asia since, at that time, most Asian rice researchers did not have ready access to other existing but Western-designed statistical packages due to their high costs. In recent years, a slightly different Windows-compatible version, called CropStat, has been developed by Graham McLaren's group and is now available online via the IRRI Web site (www.irri.org/science/software/cropstat.asp).

[Local politics and advances in the discipline led to gradual changes. The Statistics Unit became Project



Management Services and Biometrics in 1990, simply Biometrics by 1992, then expanded to Biometrics and Bioinformatics in 2001, and finally became the Crop Research Informatics Laboratory in 2006. From 1993, Dr. McLaren headed the unit until September 2008, when he left IRRI to work in Mexico for the Generation Challenge Program.]

From statistics to fund-raising

Statistical knowhow was not required to head IRRI's new Liaison, Coordination, and Planning Unit [created by Klaus Lampe, the IRRI director general at the time, in 1993 to focus on establishing close relationships with IRRI donors], and I was thus reluctant to take on the job. I finally agreed to take the job—for two reasons. First, IRRI was having financial difficulties and someone needed to go out and look for funds to sustain its operations. I believed that I owed IRRI a lot. I had gained a good reputation in the statistics discipline because of IRRI. So, I wanted to repay. A special unit for donor relations was never tried before. Somebody had to set up the system and I was pleased to help.

Second, even though I wasn't sure if I had the right qualifications

JOSE RAYMOND PANALIGAN

KWANCHAI GOMEZ and her "statistical" successor Graham McLaren inspect a plot of IR36 at IRRI. Some attribute the selection of this famous rice variety—once one of the world's most widely planted—to the use of proper experimental design and statistical analysis.

to do the job well, I knew that Lampe trusted me and I trusted him, which was an important ingredient for the success of such a unit. Besides, Lampe was a good fund-raiser and had in fact taught me a lot. I knew that I could always count on him to help me out when I needed it.

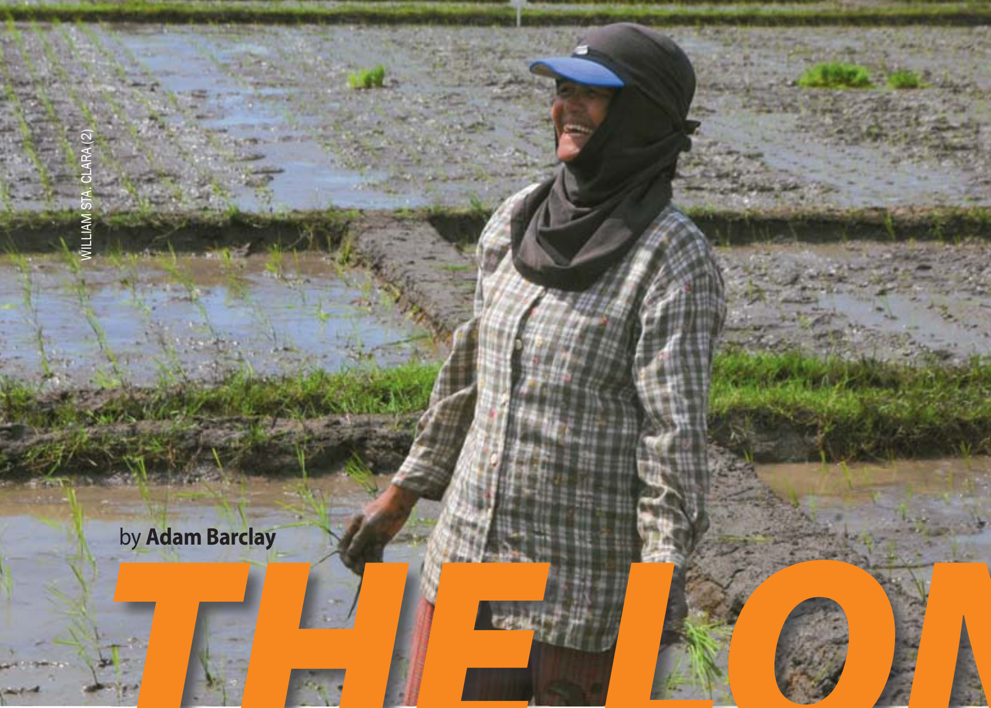
A call to arms

When Lampe arrived as director general in 1988, I was just a working scientist and never had much of a chance to see him. However, one day, he called me to his office saying there was a problem: "Your son Victor [who was 10 years old at that time] brought a fake gun to the international school today," he frowned, "and he had a 'real' bullet as well. The school principal wasn't very happy about that." I thought to myself, "Oh, my god, how could Victor bring a real bullet to school and where did he get it from? Then, Lampe immediately said, "You know any boy at his age might do something like that. Don't worry too much about it." With a great sigh of relief, I said, "Oh, ok, thank you," and left his office in a hurry.

Now, I didn't know Lampe well before this and it was the first time we had really ever talked. But, two days later, he called me again to his office. I thought to myself, "Oh, what did Victor do this time?" But I was wrong; it had nothing to do with Victor. Lampe told me IRRI was being asked to do strategic planning. It would be the first time for such an exercise at IRRI and he needed somebody to organize the group that would prepare the plan and he would like me to handle it.

He added that this task would really take a lot of my time and I may not have time to do statistics. At the time, I thought he just wanted me out of statistics, but then maybe he saw something in me earlier in the week when we discussed guns and bullets. I thought long and hard about his request and finally said: "Ok, I will agree as long as I still can be in the Statistics Department. Strategic planning shouldn't take the whole day, so he said, 'Sure, sure, sure.'" Of course, not many years later, he changed his mind about me staying in statistics. But, anyway, we became close coworkers, more so for me than with any other directors general during my 32 years at IRRI. So maybe Victor was responsible for bringing us together. Otherwise, he may have never noticed me.

Go to www.irri.org/publications/today/Pioneer_Interviews.asp to read the full transcript of the Kwanchai Gomez interview in which she discusses more about her IRRI experiences, including her recollections of six directors general and other colleagues and her work today with the Asia Rice Foundation.



by **Adam Barclay**

THE LONG RO

Forty-five years of painstaking research have shown that modern, intensive rice farming is sustainable and can even improve soil health

Just outside the town of Los Baños, around 60 kilometers south of Manila, sits a one-hectare patch of land that is, quite possibly, some of Asia's most valuable real estate. It's not for sale and, even if it were, you wouldn't build a house, or a car park, or a shopping mall on it. But, for the past 45 years, this patch of land has revealed an extraordinary thing.

In recent years, people have begun to argue that modern, intensive agriculture is unsustainable—that it degrades the soil and, eventually, renders the land incapable of supporting worthwhile crops. However, new evidence tells us that, when it comes to rice, this is far from true.

Since 1963, the International Rice Research Institute (IRRI) has grown first two, then, from 1968, three crops of rice per year on that one hectare, in what is known as the Long-Term Continuous Cropping Experiment (LTCCE). As *Rice Today* went to press, the 134th crop is under way. The time between harvesting one crop and planting another has been minimal (2 to 3 weeks), and crop residue has been removed after harvest, rather than incorporated into the soil.

What did IRRI's researchers find? The answer flies in the face of what many people now believe. In short, with appropriate fertilizer management, not only can yields be maintained, but soil health can be improved as well.

A recent paper[1] by Roland Buresh, Mirasol Pampolino, and Eufrocino Laureles from IRRI, and Hermenegildo Gines from the Philippine Rice Research Institute (PhilRice), summarized the decades of LTCCE information in a report on the soil health in four long-term trials managed by IRRI, including two at the Institute's Los Baños headquarters.

According to the paper, "The results suggest that continuous cultivation of irrigated rice with balanced fertilization on submerged soils maintained or slightly increased soil organic matter and maintained soil nitrogen (N)-supplying capacity."

Soil organic matter—which comprises living organisms and the decomposing remains of once-living organisms, including animals, plants, and microorganisms—is a vital component of healthy soil. High amounts of soil organic matter enhance the soil's water- and nutrient-holding capacity and improve soil structure for plant growth. Healthy soils can also reduce the severity and costs of such problems as drought, flood, and disease.

Over a 15-year period (1983-98), the study also found no decline in the amount of N able to be supplied to rice plants by the soil.

In other words, it *is* possible to farm rice intensively, to do it for a long time, and to use mineral (nonorganic) fertilizer without degrading the soil or the land's productivity. In fact, if you manage the crops well, you can improve things.

According to Achim Dobermann, IRRI deputy director general for research, the experiment is

[1]Pampolino MF, Laureles EV, Gines HC, Buresh RJ. 2008. Soil carbon and nitrogen changes in long-term continuous lowland rice cropping. Soil Sci. Soc. Am. J. 72:798-807.

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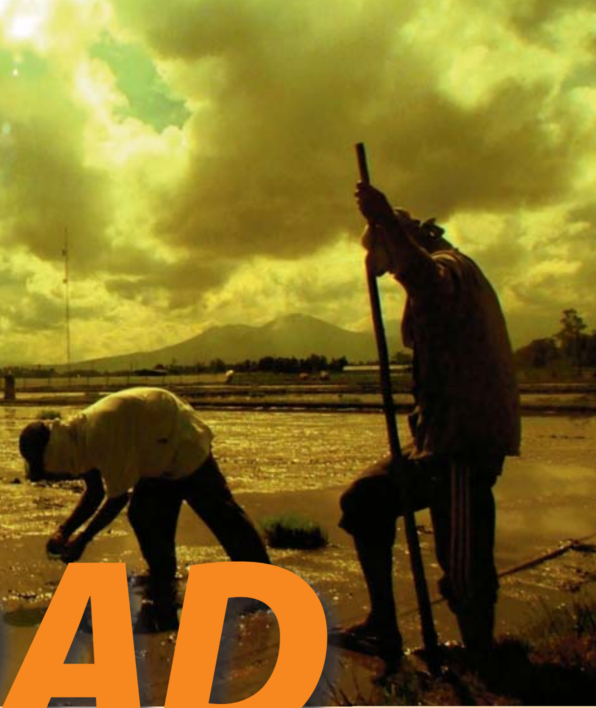


A RAINBOW arches over IRRI's Long-Term Continuous Cropping Experiment, now in its 45th year. Farm workers (*left and center*) plant the experiment's 134th crop in September 2008.

ARIEL JAVELLANA

a testament to the painstaking dedication, attention to detail, and quality of management and measurement that dozens of Institute staff have applied over the past 45 years.

"The big message," says Dr. Dobermann, "is that, with the right amount of fertilizer and good management, we can produce 18 or more tons of rice per year on a very sustainable basis. Intensive rice monocropping can actually be a very sustainable system."

Dr. Buresh, who took over as the LTCCE's lead researcher in 2000, explains that unique properties of submerged soils make rice different from any other crop. Because of prolonged flooding, he says, farmers are able to conserve soil organic matter and also receive free input of N from biological sources. This biological N fixation amounts to around 25 kilograms per hectare per crop, enough to help ensure a stable yield of about 3 tons per hectare per crop in the absence of applied fertilizer N. And, this has been sustained for the 45 years of the LTCCE.

"None of the world's other major cropping systems has these features," says Dr. Buresh. "It's for these reasons that rice monoculture systems have been around for thousands of years and sustained whole civilizations."

Another unique feature of continuous (double or triple) rice-cropping systems revealed by the LTCCE is that, at least under tropical conditions, farmers need not apply manure or other organic materials to maintain soil organic matter. Nor is it necessary to retain large amounts of crop residue (straw).

"High-input, intensive agriculture is often sustainable agriculture too," says Dr. Dobermann. "There are many misperceptions about the impact of mineral fertilizers. The LTCCE routinely yields nearly twice as much rice per hectare per year than an average rice farm. This is possible only through judicious use of fertilizers. Although the LTCCE field has never received any organic fertilizer, it is a very sustainable system."

Dr. Buresh points out that typical Asian rice farmers have access to limited amounts of organic fertilizer. IRRI therefore focuses simply on the principles of nutrient management and soil fertility that can achieve high yields year in, year out, without compromising soil or environmental health.

"To do this, we need to equip farmers with better knowledge and simple tools that they can use for adjusting nutrient inputs to their locations and needs," explains Dr. Buresh. "Farmers who have access to organic fertilizers on an economical basis should use them, but, in many cases, they will need to supplement them with mineral fertilizers because organic fertilizers often contain insufficient nutrients for optimizing rice yields."

The significance of the LTCCE is perhaps best summed up by Robert Zeigler, IRRI's director general. "I know this might sound silly," he says, "but when I read the LTCCE paper, I felt shivers of excitement rolling over me as I internalized what 45 years of experimentation means."

The story does not end here. With support from PhilRice staff, similar observations were made in long-term trials with double-cropped rice systems at two other locations in the Philippines. With the LTCCE, many of these trials will continue to provide vital information about the sort of agriculture that will be needed to feed the world in the decades to come. Moreover, the trials are used to address short-term objectives such as testing promising varieties under high-yield management, and trying new nutrient-management strategies.

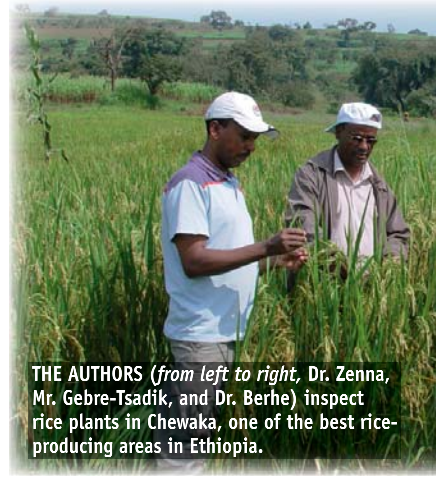
Worryingly, it is increasingly difficult to find support for such long-term work. Dr. Zeigler notes that it would be a momentous loss if the LTCCE—which could almost be considered a world rice heritage site—were compromised by lack of funding. Yet, he points out, "It is investment in this sort of research that can answer questions of truly global importance."

William Sta. Clara

Farm workers transplant the 134th crop of an IRRI Experiment that has shown that long-term intensive rice production can be sustainable.

Moving up in Ethiopia

by **Negussie Shoatatek Zenna, Zewdie Gebre-Tsadik,** and **Tareke Berhe**



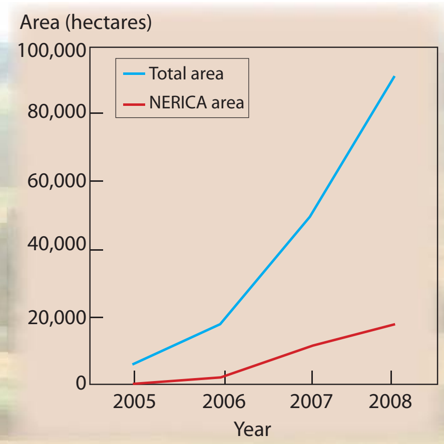
THE AUTHORS (*from left to right,* Dr. Zenna, Mr. Gebre-Tsadik, and Dr. Berhe) inspect rice plants in Chewaka, one of the best rice-producing areas in Ethiopia.

If successful, initiatives to boost rice production in Ethiopia can help the country achieve food security

Geographically, Ethiopia's vast land area—1.12 million square kilometers—is defined by the Great Rift Valley system, which cuts the whole country diagonally from the Red Sea through to Kenya, creating mammoth depressions and mountain ranges. As a result, the country possesses unique and diverse geo-climatic zones.

Agreeable weather conditions make the mid to high altitudes the predominant locations for human settlement and crop production. Consequently, population pressure and an archaic farming system at these altitudes have caused tremendous ecosystem degradation in the form of soil erosion and declining soil fertility. This situation, together with the Rift Valley's typically erratic climate, means that prolonged cold and dry spells are challenging the country's ability to achieve food self-sufficiency (producing enough food) and food security (ensuring that everyone has access to sufficient food).

Rice was introduced to Ethiopia in the 1970s and has since been cultivated in small pockets of the country. It is a staple food in the country's east, where rice is imported through Somalia on the black market. Recent surges in demand, especially from city dwellers, are forcing the government to spend large amounts of money on importing rice.



RICE AREA trends in Ethiopia, 2005-08.

The rice production system in the country has focused mainly on the introduction of improved varieties from a range of different sources, including the International Rice Research Institute (IRRI), the Africa Rice Center (WARDA), Guinea, and Madagascar. Federal and regional research centers are concentrating on the evaluation and release of new varieties for local producers. Three improved irrigated varieties from IRRI and four "New Rice for Africa" (NERICA) varieties from WARDA were released to farmers in 2005-07. In farmers' fields, the NERICA varieties—grown in the rainfed uplands, where farmers do not have access to irrigation systems—registered yields of 3–6 tons per hectare. The IRRI varieties, grown in lowland irrigated conditions, achieved 6–8 tons per hectare.

The Sasakawa Africa Association (SAA) through its Sasakawa Global 2000 (SG2000) program has played a key role in promoting NERICA and other cultivated varieties to the country. In addition, the Japan International Cooperation Agency (JICA) and SAA have supported the introduction of essential postharvest (storing, milling, drying) technologies and processing machinery to rice-producing areas.

The recent surge in demand for rice combined with the skyrocketing import price challenged the country's

A YOUNG boy from Gura Ferda in southern Ethiopia shows off a local rice variety named X-jigna white.

BIRHANE GOBEZAI

policymakers to seriously consider the country's potential to grow the grain for itself. Subsequently, successful lobbying has pushed rice to be classified as a fourth "National Food Security Crop" after wheat, maize, and the country's traditional staple cereal crop, tef. This move favors rice research and promotion on a larger scale. A national workshop was held on 21 August 2007 in the Ethiopian capital, Addis Ababa, where the National Rice Promotion Committee was formed, to facilitate the establishment of the National Rice Research and Development Steering Committee.

Currently, 18 improved rice varieties (both NERICAs and *Oryza sativa*, conventional cultivated rice) are being evaluated in different regions. Rice production is expected to cover about 90,000 hectares in 2008, up from 49,000 hectares in 2007. This figure is projected to reach 400,000 hectares by 2010, with NERICA varieties expected to dominate.

However, if rice is to contribute to the nation's food security, it must be grown on a larger scale in ecosystems not already devoted to traditional or cash crops preferred by local farmers. Fortunately, the country has more than 13 million hectares of waterlogged black-clay soil (known as vertisol) in the mid and high altitudes. Much of this land is occupied by resource-poor subsistence farmers for whom growing rice presents good opportunities to supplement their current meager income.

The water-logged nature of the soil and the characteristic cold climate of high altitudes are the major constraints to crop production in these areas. Nevertheless, rice grows well in waterlogged conditions and rice varieties exist that can grow at high altitudes in cold weather. Preliminary evaluation of a selection of local varieties revealed good vegetative growth but low night temperatures meant that most of the cultivars remained sterile or required a prolonged harvest time.

Despite these early setbacks, the accessibility of many samples of cold-tolerant rice in IRRI's International Rice Genebank and the large area of available fertile land mean that Ethiopia has great potential to become a major rice-producing country. Recognizing this opportunity, Tareke Berhe, director of SAA's regional rice program, has initiated a project to evaluate cold tolerance in rice.

The project aims to develop rice varieties that can be grown by small-scale farmers in cool-climate elevated areas. Success would create a huge opportunity to support a large number of resource-poor farmers and contribute to Ethiopia's food security.

With assistance from IRRI Rice Breeder for Africa Glenn Gregorio, Dr. Berhe obtained 130 rice varieties from the International Network for the Genetic Evaluation of Rice (INGER), as well as six lines from Madagascar. Negussie Shoatatek Zenna, postdoctoral fellow at SAA and a former IRRI Ph.D. scholar, is currently evaluating these lines in four locations at 1,860, 2,260, and 2,400 meters above sea level. So far, about 40 of the lines have shown promising growth at the different sites.

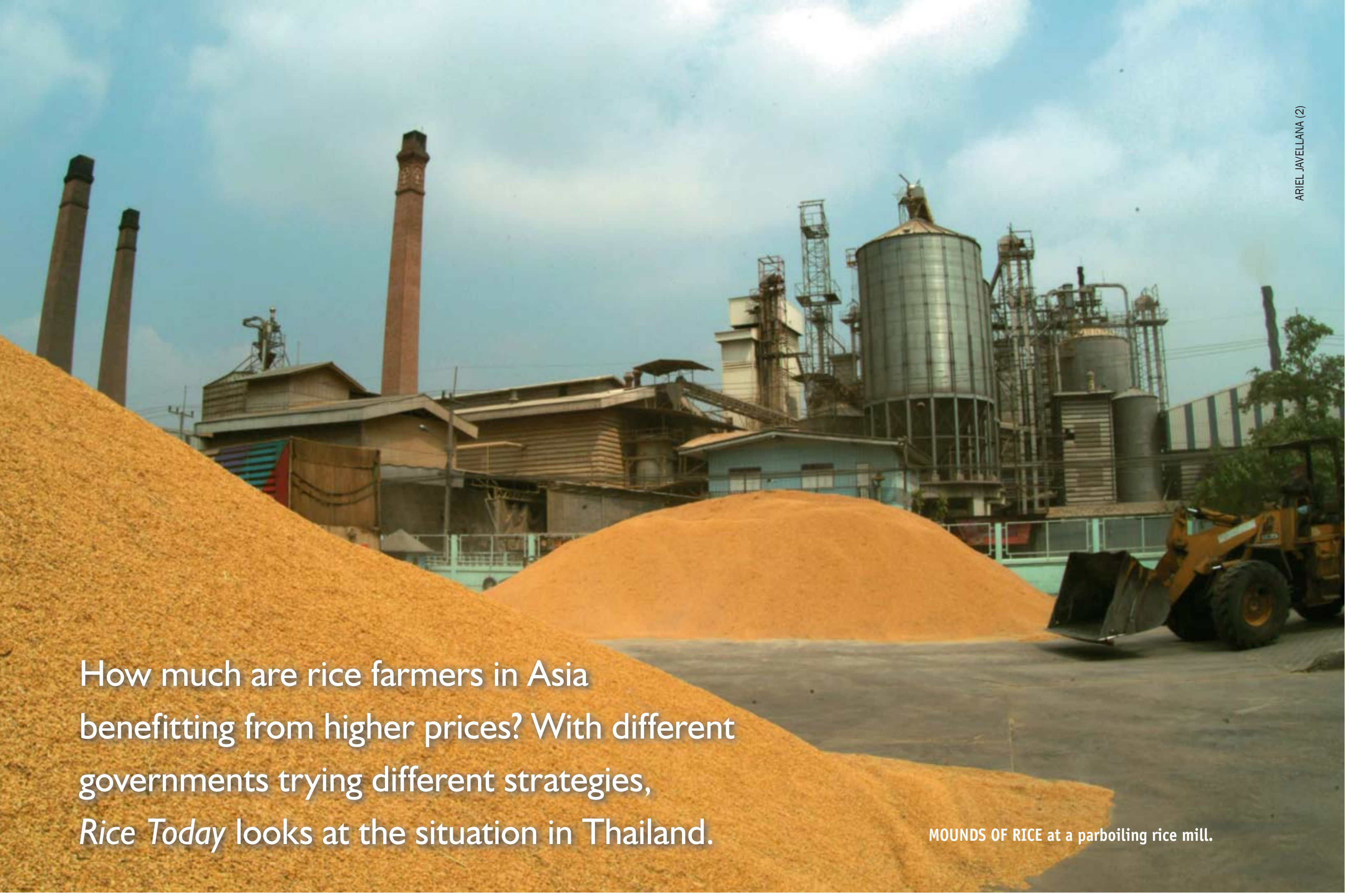
TAREKE BERHE (3)

A THRESHING demonstration in Fogera.

A similar initiative led by IRRI and WARDA, which aims to develop climate-hardy rice tailored to a number of rice-producing countries, including Ethiopia, is set to begin with financial support from the Bill & Melinda Gates Foundation.

As rice production takes off in Ethiopia, participation and support from international organizations such as IRRI, WARDA, SAA, JICA, and others is crucial. This is especially so in such areas as seed multiplication of selected varieties, evaluation of rice germplasm (seeds and the genetic material they contain) for specific traits, the introduction of rice-production and postharvest technologies, training of rice breeders, and developing and lobbying for effective agricultural policies. With such support, rice production in Ethiopia has a chance to bring a long-awaited Green Revolution and, with it, the plentiful and affordable food that the country needs.

Dr. Zenna and Dr. Berhe are a postdoctoral fellow and regional rice coordinator, respectively, at the Sasakawa Africa Association in Ethiopia. Mr. Gebre-Tsadik is Ethiopia's rice agronomist for Sasakawa Global 2000.



How much are rice farmers in Asia benefitting from higher prices? With different governments trying different strategies, *Rice Today* looks at the situation in Thailand.

ARIEL JAVELLANA (2)

MOUNDS OF RICE at a parboiling rice mill.

by **Bob Hill**

Shaking the invisible hand

Many of Thailand's 3.7 million rice farmers are unhappy. As the producers of the world's biggest rice export crop, they believe their share of the 2008 rice price bonanza should have been a lot bigger. They now see the high prices slipping away before they can taste the sweetness of new wealth.

Early in June, they threatened to rally in Bangkok if the government didn't make some effort to halt the slide of rice prices from their peak in May, back toward "normalcy."

What the Royal Thai government has done to prop up the high prices is now a controversial part of the political turmoil that grips the country and that tangles all aspects of Thai life in a soap opera of intrigue, suspicion, and accusation.

World rice prices, which began to skyrocket in late 2007, were spurred by high demand and a decision by some exporting countries to opt out of the world market for the sake of their domestic food security.

A distinct minority of Thai rice farmers—those who would normally be regarded as wealthy; they cultivate irrigated land and produce as many as five crops in two years—struck it rich. Others have been able to meet their debts this year, while many poorer Thai farmers in the rainfed (non-irrigated) environment have yet to see any benefit at all. Rice millers and any exporters who were not badly burned in the explosive market of early 2008 (see *Troubling Trade*, on pages 13-17 of *Rice Today* Vol. 7, No. 2) are believed to have been the main beneficiaries.

For most farmers, who are able to grow only one crop per year, the near-record prices of April and May came between crops, when they had nothing to sell. Their dismay grew as they watched the high prices dwindle before they could harvest again.

At its peak in early-to-mid-May, the price for 5% white rice (an export grade comprising maximum 5% broken grains) was US$1,022 per ton, and that for the premium grade of Thailand's legendary Khao Hom Mali (Jasmine rice) was $1,245 per ton. Those exporters and millers with the good fortune to have stocks on hand and the foresight to resist the urge to sell forward did very well. Others, learning from their early mistakes, recovered to reap rewards.

In the first 6 months of 2008, Thailand exported 5.97 million tons of rice—46.7% more than was shipped in the first 6 months of 2007—worth almost $3.5 billion. In July, shipments were just short of 1 million tons, and, in August, about 735,000 tons. Industry representatives were confidently predicting a record year with exports totaling 10 million tons.

Thailand's gross domestic product rose by about 6% in the first half of the year, most of it coming from increased world prices for agricultural products, particularly rice. In that time, the value of the country's exports leaped by about 30% compared with the corresponding period in 2007.

But, in the middle of May, prices began to fall again. Vietnam resumed exporting, India looked set to return to the global market, and importers stood back, waiting for cheaper deals. In early September, 5% white rice was selling for $760 per ton and Hom Mali 100% grade A for $913.

The small part of the brief bonanza that made its way down to the average farmer lost most of its gloss for two big reasons: increased production costs and chronic indebtedness.

The Thai Farmers' Association says the cost of producing 1 hectare of rice in 2004 was $695. In 2006, this rose to $871, in 2007 to $1,019, and in 2008 to $1,296. Thailand imports all but a tiny fraction of the raw material for its fertilizer, and the cost has risen nearly 2.5 times in the past 4 years. Pesticide costs and seed prices have both doubled, and fuel costs for machinery have soared. The cost of renting land has also skyrocketed, affecting about one-quarter of rice farmers across the country.

About 80% of Thailand's rice farmers carry an amount of debt variously described as relatively high to alarming. Their debt rises and falls in a constant rhythm, following the crop cycle—leaping with land preparation and planting, falling and occasionally disappearing with harvest.

At the same time, as many as 95% of Thailand's farmers—excluding only the very poor—have access to a wide variety of easy credit sources, from commercial and state-owned banks through to the undisciplined use of government money in local village funds. Relatively poor farmers now have a higher debt-to-income ratio than their wealthier counterparts.

While some farmers were lucky to get enough from the high prices to clear their debts, the rush of rice income into the country captured the attention of Thailand's politicians. Two of the country's

RICE STACKED in jute sacks at a rice mill warehouse in Nakornluang District, Ayutthaya.

According to some economists, the amount of debt is a direct consequence of government policy.

In 2001, the government of deposed prime minister Thaksin Shinawatra introduced a debt moratorium for farmers, allowing clients of the government-run Bank for Agriculture and Agricultural Cooperatives (BAAC) to defer their debts up to a maximum of Bt100,000 ($2,972) for 3 years, without any interest payments.

The 2008 government of Samak Sundaravej, after just a few months in office, reintroduced the same scheme, giving farmers another 3-year debt holiday.

most respected economists say the industry has been perceived as the perfect vehicle for unscrupulous politicians to direct funds either into their own pockets or into their support systems in the countryside. As a consequence, the president of the Thailand Development Research Institute and former dean of economics at Thammasat University, Nipon Poapongsakorn, and the head of the Department of Agricultural and Resource Economics in Kasetsart University's economics faculty, Somporn Isvilanonda, fear irrevocable damage to the domestic rice market and Thailand's eventual decline as the

BOB HILL (3)

ASSOCIATE PROFESSOR Somporn Isvilanonda: "Poor farmers don't get benefits from price intervention. Rich farmers get the benefits."

THAI RICE MILLS Association President Vattana Rattanawong: "Price intervention is not only supported by farmers, but also by the citizens generally."

world's leading rice exporter.

Their concerns were exacerbated by a flurry of government activity in early June. The prime minister announced the reintroduction of price intervention for the secondary dry-season crop, supposedly to assist farmers. Then, he accused Commerce Ministry officials of collaborating with exporters at the expense of farmers, and removed all responsibility for rice matters from the Commerce Ministry and vested it in his own department, with assistance from the Finance Ministry.

Prime Minister Samak then formed three new committees, one each for the price intervention program, milling, and release. The new structure was additional to the National Rice Committee, which in its role as the formulator of rice industry policy, is routinely chaired by the prime minister and attended by the ministers of commerce, finance, and agriculture, as well as their departmental heads and other senior officials.

Then, as the export price for 5% white rice fell to about \$856 per ton, and under intense pressure from farmers, the government announced its above-market-value intervention prices for the 3-month period between 15 June and 15 September. It pledged \$405 per ton for white rice paddy (unmilled rice) with moisture content up to 15%. The price was progressively lower for higher moisture content, paying \$361 to \$376 per ton for paddy with a moisture content of 25%.

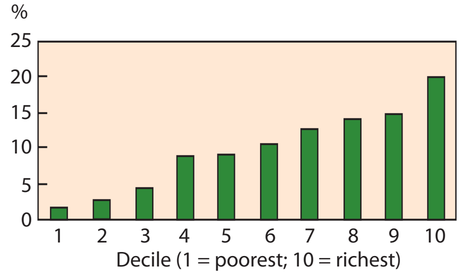
Putting this in perspective, the paddy sold by farmers for \$376 per ton, with a moisture content of 25%, would increase in value to about \$434 after being dried by millers to reduce its moisture content to 15%. After the paddy was milled into 5% white rice it would then cost exporters about \$781 per ton.

Dr. Nipon and Associate Professor Somporn say the claim that price intervention will help poor farmers is a myth. They find support from the Thai Farmers' Association, which says that most farmers are incapable of delivering rice with a moisture content low enough to qualify for the top government prices.

In a recent paper,[1] the economists cited the Commerce Ministry's Department of Internal Trade as estimating the financial loss from rice market price intervention in 2005-06 at \$314 million. The program handled a record 8.65 million tons of paddy in that season. As of December 2007, the government still owed the BAAC \$1.783 billion for funding price intervention schemes between 2001-02 and 2005-06.

Moreover, the economists drew on figures from the Public Warehouse Organization, the Office of Agricultural Economics, and Thailand's National Statistical Office to show that the lion's share of benefits from price intervention went to the richest strata of Thai farmers. Using figures from the 2006-07 harvest season, when the price intervention scheme cost \$703 million, Thailand's farmers were divided into 10 equally-sized groups ranging from poorest to richest. The bottom four groups received less than 18% of the benefits, while the top four received more than 62% (see figure *below*).

"The poor farmers don't get benefits from price intervention; rich farmers get them," Prof. Somporn



DISTRIBUTION of benefits (in percentages) from the Thai price intervention program by farmer income deciles, 2006 dry season and 2006-07 wet season (combined).

ARIEL JAVELLANA

GATHERING FRESHLY unloaded rice for milling at a parboiling mill.

[1] *Key Policy Issues in the Thai Rice Industry: Myths, Misguided Policies, and Critical Issues*, delivered at a Rice Policy Forum organized by IRRI at Los Baños, Philippines, 18-19 February 2008.

confirms. “Wishing to help poor farmers is a fine sentiment, but when the intervention price is higher than the market price, you destroy the market in the long run. Small operators cannot survive.”

An immediate problem from this year’s price intervention scheme was the forcing of Thailand’s export quotations above those being offered by Vietnam. In the countryside, local wholesale rice trading has been strangled by successive years of price intervention. Having been bypassed, smaller middlemen are closing their

doors. One of the country’s biggest private rice markets at Nakhon Sawan, in the heart of the central rice bowl, has become a storage operation.

In the first month of this year’s 3-month intervention scheme, the government-run BAAC bought 508,506 tons of paddy, worth $200 million, from 38,285 farmers. This, it said, represented 20% of its target.

Earlier intervention schemes were administered by major millers, but most commentators say the vast, confusing circus between the farm gate and retailers or exporters is where graft thrives. Dr. Nipon and Prof. Somporn cite the board of the Public Warehouse Organization as saying that more than 200 millers are being sued for breach of contract. Several years ago, there were also widespread instances of Khao Hom Mali being blended with lesser-quality grain while in the hands of millers. Many such cases have been referred to the National Counter-Corruption Commission.

Thailand has as many as 10,000 rice millers. As with smaller traders, most millers, at the bottom end of the wealth and turnover ladder, are being bypassed or, at least, disadvantaged by the intervention scheme. Only about 220 rice mills have joined the program and are responsible for receiving, milling, and helping to store the government’s rice stockpile. And, with the first 2008 price intervention scheme just finished, another is expected to begin in November, to cover the country’s main harvest.

During the 2006-07 term of the military government that preceded Prime Minister Samak, about 55 millers were blacklisted for illegal practices and cheating. There was uproar in the industry in August when the Samak government announced that blacklisted millers would be allowed back in, to take part in the upcoming scheme. The millers had complained about the need to pay fines amounting to about $42 million, and said they were already suffering because of the high market prices. Their trade association also asked that millers be allowed to share in government-to-government deals, a request the government not only acceded to by granting them half of its government-to-government business, but also undertook to find financial support for them.

Farmers and exporters were outraged, saying the decision was tantamount to encouraging the guilty to re-offend.

“Most of the millers are either politicians or are politically involved,” says Dr. Nipon. “Rice policy is no longer based on business decisions, but on political decisions, and, if we can’t halt this phenomenon, sooner or later, farmers will get hurt.”

ARIEL JAVELLANA

A MILL WORKER unloads rice for milling.

As one of Thailand’s most respected analysts in the field of agricultural economics, Dr. Nipon says Thailand’s rice industry has become a system that allows politicians to distribute largesse to their support networks in the countryside.

“Yes, exactly!” agrees the president of the Thai Farmers’ Association, Prasit Boonchuey, saying that rice is being used as a political tool to create short-term popularity for the government in rural communities.

Mr. Prasit’s frustration with government policy is clear. “The government should be thinking of long-term development assistance, to allow farmers to help themselves.

THAI FARMERS’ ASSOCIATION President Prasit Boonchuey: “Farmers don’t want to be the tools of politicians.”

Instead, we're stuck with short-term intervention. Farmers have become dependent upon the government, and that is how the industry has become a political tool."

Prof. Somporn is a member of the National Rice Committee, which sets official rice policy, but he is bitterly opposed to the way the industry is being administered.

"I argue with the prime minister," Prof. Somporn says. "I say they should establish a policy for the future, because the market is more dynamic than they realize. I suggested an option pricing system, to allow the private sector to function. They said no. They are not at all knowledgeable about the rice industry, and they have no use for academic analysis. They operate according to their own political feelings." More thoughtfully, he adds: "I can't leave, or there would be nobody to argue with them."

The 3-month price intervention scheme for the dry-season crop had a budget of $743 million, covering not only purchases but also milling, storage, and fumigation. The real cost is a matter of debate.

"In the paddy pledging program, everyone benefits at the expense of the taxpayer," says Dr. Nipon. "Yet we don't know how much is being spent. The system is designed to hide these things.

"Hundreds of rice millers with political connections are investing in new silos because they know the government will rent their storage space. When they get [government] rice in their silos, the first thing they do is sell it to buy more rice. It's like investment capital. When the government wants its rice, they [the millers] simply buy some more to replace it.

"We don't know what the cost is to the public. The financial and economic cost of this program is never known. But we know it is several billion baht."

At the other end of the scheme, selling the government's stockpiles is another hot issue. Despite the stratospheric prices, the Thailand government began the year with 2.1 million tons of stockpiled rice, some of it from as long ago as 2004. Throughout the high world demand, nothing moved. If the secondary harvest scheme went as expected, the stockpile should now be more than 4 million tons.

"I pushed hard for the government to sell its rice when the price was at its peak," says Prof. Somporn. "But it was worried about domestic food security. That was before they learned that there would be another harvest within 4 months. But we still lost the opportunity to sell at peak prices because the government's decision processes are extremely slow."

The government was quick, in April, to dust off an old proposal for the formation of a cartel of rice-producing countries to effectively control the international price of rice. The plan, to include Thailand, Vietnam, India, Pakistan, and China—collectively accounting for 79% of global rice exports—brought a storm of horrified reaction and was shot down by Vietnam even before it could be proposed to the would-be partners.

In June, Thailand also missed an opportunity to sell 675,000 tons of rice to the Philippines in a government-to-government deal. The Philippine proposal was taken off the Cabinet agenda in Bangkok on 10 June and ignored.

The move followed a visit to the Philippines by Prime Minister Samak,

ARIEL JAVELLANA (3)

during which he promised to sell rice at "friendly" prices to the Philippines on a government-to-government basis, on the condition that no bids or prior Cabinet approval were required.

When there was no bid from Thailand, the Philippines announced it had struck a deal with Vietnam.

Perhaps predictably, the Thai Rice Mills Association sees no likelihood of damage to the rice industry from the price intervention scheme because it says the intervention level is not extremely high.

The association's president, Vattana Rattanawong, says it is expected that about one-quarter of the country's main rice crop will enter the scheme. This will amount to about 5.7 million tons if the main crop reaches its usual 23 million tons of paddy.

"If exports continue at the present volume, there will be no market collapse," Mr. Vattana says. "In fact, we expect exports will rise year after year. This scheme is not only supported by farmers, but also by the citizens generally.

"Rice exporters don't agree with the scheme because they want to control the market; they want the lowest prices. Rice millers are closer to farmers. We have to support farmers, because farmers must in future grow the same quantity of rice on a smaller area of land. This will demand new varieties of rice."

The Rice Mills Association claims the government spends no more than $119 million per year on the pledging scheme. "When that's divided among 20 million farmers, it's not much," Mr. Vattana says.

BOB HILL

DR NIPON Poapongsakorn.

RICE BEING UNLOADED from trucks at a parboiling rice mill.

Prof. Somporn says that, by his calculation, intervention has cost $892 million over the past 3 years: "If the government prolongs this policy, it will damage the Thai rice industry."

Dr. Nipon says he's been tracking down the real cost to the Thai taxpayer. "By early next year, I should have the figures, and I will make them known to both farmers and society. We must get rid of this system."

Mr. Prasit of the Thai Farmers' Association claims the government has been losing $535 million per year because of price intervention, but adds: "Farmers are not getting anywhere near that much."

As for the future, the Thai Rice Exporters' Association predicts that Thailand's export volume will fall to 8 million tons next year because price intervention will make the Thai product uncompetitive.

However, the Thai Commerce Minister says the coming harvest will see the highest intervention prices ever—$446 per ton for white rice paddy and $565 for Khao Hom Mali. The prime minister has raised the idea of a government department to especially handle the rice industry, and says the government's stockpiles in 2009 will rise to about 5 million tons.

"If this government screws up, it will mean less rice for the world," declares Dr. Nipon. "Thailand will cease to be the leading and most reliable supplier of rice in the world.

"Exports will decline because Thailand's price will be higher than others. Then the government will have to inject more and more money into its price support system until it gets to the point where it says: 'we can no longer afford to do this.' Then the whole thing will collapse."

After this article was written, Samak Sundaravej was removed as the Thai prime minister by the country's Constitutional Court because he had contravened the conflict of interest provisions of the Thai Constitution by hosting TV cooking shows while in office. Members of the ruling coalition later boycotted a Parliamentary session in which he was expected to accept his party's nomination to resume the top office and he was forced to stand down. The same coalition has since elected Somchai Wongsawat as its new leader. The Commerce and Agriculture Ministers have not changed.

Bob Hill is a Thailand-based writer specializing in science and technology.

Note: Apart from export prices, which are quoted internationally in US$, all US$ figures were converted from Thai baht at the 29 September 2008 rate of US$1 = Bht34.15.

Management made easy

A new decision-making tool is helping rice farmers optimize their use of nutrient inputs

by **Roland Buresh**

The largest expense for rice farming after labor is typically the purchase of fertilizers. Fertilizer prices have dramatically increased in recent months, making it ever more important that rice farmers use the most profitable fertilizer management practices for their growing conditions. This requires farmers to select a combination of fertilizer sources, timing, and dosages that provides the highest incremental increase in rice yield per added cost. Such a selection can involve complex decisions for farmers, which are made even more daunting by the myriad available fertilizer sources and recommendations.

Fortunately, a partnership of national and International Rice Research Institute (IRRI) scientists across Asia have, through nearly 15 years of research, developed an improved site-specific nutrient management (SSNM) approach for rice. This approach—which enables farmers to effectively apply the three major plant nutrients (nitrogen, phosphorus, and potassium) as and when needed by their rice crop—has consistently increased rice yields and profit in on-farm evaluations across Asia.

The SSNM approach is a relatively knowledge-intensive technology in which optimum fertilizer management for a rice field is tailored to specific local conditions for crop yield, growth duration of the rice variety, crop residue management, past fertilizer use, and input of nutrients from organic materials and sediments. Such knowledge requirements have slowed the wide-scale promotion and uptake by farmers of SSNM. Uptake by farmers has also been constrained by confusion arising from the contrasting, and often contradictory and competing, recommendations for nutrient management received from different sources.

IRRI has consequently worked with partners in both the public and private sectors to consolidate existing knowledge on nutrient best management practices into concise principles and guidelines accepted and promoted across multiple research and extension (technology dissemination) organizations. Now, to facilitate the consolidation and dissemination of such intensive knowledge, scientists have developed easy-to-use, interactive computer-based decision tools for extension workers and farmers.

In Indonesia, IRRI and partner organizations within the Indonesian Agency for Agricultural Research and Development have worked together to consolidate divergent soil testing, soil mapping, and plant-based approaches into one concise national

FARMERS IN INDONESIA mixing fertilizer (potassium chloride and urea) for application to rice at panicle-initiation stage.

MONINA ESCALADA

IRRI CONSULTANT Mira Pampolino demonstrates a nutrient-management module in Indonesia.

PJ SINOHIN

nutrient management guideline for rice now disseminated throughout the country. Scientists developed in 2008 software named *Pemupukan Padi Sawah Spesifik Lokasi* (*Rice Fertilization for a Specific Location*). PuPS, as it is known, consolidates existing knowledge from years of research. PuPS, along with an associated training module, was ceremonially released by President Susilo Bambang Yudhoyono during the Indonesian National Rice Week in July 2008. The PuPS CD is being distributed to extension workers across the country through Indonesia's Assessment Institutes for Agricultural Technology.

In the Philippines, IRRI scientists, in partnership with public- and private-sector organizations, have developed a similar tool. Named *Nutrient Manager for Rice*, it is tailored to rice-growing conditions in the Philippines. In September 2008, the Philippine Department of Agriculture began distributing the *Nutrient Manager* CD—which is available in five dialects—to local extension agencies throughout the country. In the fourth quarter of 2008, country-specific versions are set for evaluation in Bangladesh, Vietnam, and the Indian state of West Bengal.

Nutrient Manager for Rice and PuPS are designed to help agricultural technicians quickly formulate fertilizer guidelines tailored to specific rice fields or rice-growing areas. These decision tools consist of about ten multiple-choice questions that can easily be answered by an extension worker or farmer. Based on responses to the questions, a fertilizer guideline with amounts of fertilizer by crop growth stage is provided for the rice field. This helps farmers increase their yield and profit by applying the right amount of fertilizer at the right time.

These tools enable farmers to select the least expensive combination of fertilizer sources for meeting the nutrient needs of their rice crops. Fertilizer rates and timing are adjusted to accommodate a farmer's use of organic sources of nutrients. They accommodate transplanted and direct-seeded rice, including inbred and hybrid varieties with a range of growth durations. The guidelines are consistent with the scientific principles of SSNM for rice, which are based on years of research across Asia. These principles are available in the book *Rice: A Practical Guide to Nutrient Management*, which was released in July 2008 in Bahasa Indonesia and is now being released across Asia in other local languages (http://tinyurl.com/6lp8zj).

ASKING THE RIGHT QUESTIONS

IRRI's newly developed nutrient-management decision-making tool asks the following questions, allowing farmers or extension agents to determine the optimum fertilizer applications for their rice crop.

1) ***What is the rice variety?***
2) ***Is rice transplanted or direct seeded?*** Answers are used to provide guidelines on the optimal number of days after crop establishment to apply fertilizer nitrogen (N). This ensures that N is applied when most needed by the crop.
3) ***What rice yield is typically attained?*** A crop's need for nutrients increases with an increase in yield. The answer is used to adjust fertilizer rates to the needs of the crop.
4) ***Is rice straw retained or removed from the field after harvest?*** Straw contains about 80% of the potassium in a mature rice plant. The answer is used to adjust the rate of fertilizer potassium to the farmer's management practices.
5) ***What source and amount of fertilizer was applied in the previous season?*** The answers together with the answer on yield are used to estimate whether soil phosphorus fertility has been built up or depleted. Fertilizer phosphorus rates are adjusted accordingly.
6) ***What source and amount of organic fertilizer will be applied?*** The answers are used to estimate nutrients supplied from organics, when used by a farmer, and to adjust rates of inorganic fertilizer accordingly.

Dr. Buresh is a senior soil scientist at the International Rice Research Institute. For more information on nutrient management, see www.irri.org/irrc/ssnm.

The fun is in the dirt

by **Meg Mondoñedo**

ARIEL JAVELLANA

Rice Today interviews Achim Dobermann, soil scientist and new deputy director general for research at the International Rice Research Institute (IRRI), about life, work, and what could have been…

"If you were to interview IRRI's deputy director general for research, what would be your first question?"

Achim Dobermann thinks for a moment, then says, "If you had the choice, which of your responsibilities would you drop?" then laughs.

"And would you like to answer that?"

"No," he says with a straight face, then a chuckle, then silence.

It's impossible to put Dr. Dobermann in a box. He is serious yet funny, modest but outspoken, focused but far-reaching.

Now, after working as a researcher for nearly 20 years, he believes that he can make his biggest contribution by applying his broad experience to managing and directing science—to helping other scientists succeed in the interest of a larger institution.

Dr. Dobermann, a soil scientist and agronomist, has led research on global issues of cereal production, crop management, and climate change in Asia, North America, and Europe. As deputy director general for research, he oversees IRRI's research on rice improvement, management of rice systems, genetics and genetic resources, policy, information management, and capacity building. He has published more than 200 research papers, including 90 papers in peer-reviewed international journals. He is an elected Fellow of the American Society of Agronomy and the Soil Science Society of America, and he has received numerous international and national awards for his contributions to agricultural research and development.

A fan of great minds

"Certain people have influenced me," he says, "whom I've read about but never met, because most of them died a long time ago, but who have impressed me with their strength of character or contributions they have made to society."

On top of his most-influential-people list is Charles Darwin for "the amount of dedication he gave to science and his struggle to put his scientific discoveries in line with the prevailing values." Nelson Mandela and Mahatma Gandhi come next "for their enormous passion and dedication to a cause and staying on course for a long, long time."

Then, there are people he knows, who have had a more direct influence.

"I had a very good professor in college back in Germany," he says. "A soil scientist who was able to teach science in a visual, engaging way; without him, I wouldn't have been interested in science and agriculture."

A day in the life...

"Typically," says Dr. Dobermann, "I try to be at the office by 7:30 a.m. to get some quiet time before things get really busy."

Then there's reviewing policies and research agendas, writing papers, attending meetings, and talking with scientists. In between all that, he has to answer around 100 emails a day, many of which require some sort of attention or decision-making.

"I also spend a lot of time meeting with individual scientists in their offices, in the field, or in the lab to keep a close eye on what's going on in a research sense."

One of the responsibilities of a DDGR is to ensure that the institute is focusing on the kind of research that will benefit rice farmers and consumers. Dr. Dobermann must look at things critically from a broad perspective and, when necessary, challenge people.

"An institute can only survive if it has the ability to critically self-evaluate what it is doing," he says. "That's a very important role for me to play."

Despite the workload, though, "Science is wonderful. Getting paid for doing something I love is great. I'm happy to be in a position where I can help make decisions that make a positive impact on others. It's that big mission of contributing to an even bigger goal here at IRRI."

Date with fate

"I had no clue what a soil scientist even was until I started college," Dr. Dobermann recalls. "It was the very first class I took. I had this exciting professor and it immediately clicked with me. It was very much by chance; I didn't even know it existed. As a teenage kid, I went through the usual phase of not knowing what I wanted to be. At one point, I thought I'd become a lawyer or a chemical engineer or—whatever—until I was, more or less by chance, pushed into agriculture. And I stuck with it."

Where's the fun in soil science?

"The fun is in the dirt," he says. "Many people have no clue what's beneath the surface. They look at it as an abstract brown or red or yellow material that can be used to build houses but the real fun is understanding what the soil is, how it was formed; why are there rocks here, no rocks there? Soil is a living thing; there are bugs in there and all sorts of things you can't see—and that's exciting. It's as exciting as the stuff that's going on above-ground."

WILLIAM STA. CLARA

Did you know...?

Dr. Dobermann grew up as part of a farming family in a small village of about 300 people in southern East Germany. As a child, he was exposed to agriculture. "But it really didn't excite me that much," he says. "At one point, I wanted to become a professional soccer player. I was quite good, I think. I must have been 12 or 13 when I was supposed to go to a training camp held by one of the leading soccer clubs in East Germany, where they would select the next talents. But, when the day came, I was so scared that I didn't show up. So that was the end of my professional soccer career. If I'd gone, I might not be here at IRRI now."

Nine years in the Philippines

Dr. Dobermann likes pork *adobo* [a Filipino dish of meat cooked in garlic, vinegar, and soy sauce] and *sinigang* [meat cooked in tamarind soup with local vegetables]. But, most of all, he appreciates the friendliness and strong family orientation of Filipinos.

On the media

"I like it when interviewers ask questions that imply that they have a distorted view of the life of a scientist. Often, the public's view of a scientist is the weird looking nerd with a wild haircut, sitting in the lab, brewing things up, with no family life whatsoever. But science is a bit like art. It's not dull, dry work. You need to be very creative and you need to have fun with it."

Ten years from now...

"IRRI five to ten years from now needs to be bigger and more focused at the same time," says Dr. Dobermann. "It needs to be more flexible and be able to provide an even better environment and facilities for the staff to work well. We need to find new ways to help solve the major development challenges. "

He also emphasizes the need to expand IRRI's partnerships and work more closely with a much wider range of public- and private-sector partners.

"As DDGR, I constantly think about the four most important aspects of my job: Are we doing the right science? Do we have the right people in the right place? Do they have the right resources and partners? How can I protect them and help them succeed?"

Trying to answer these questions is what makes him one of the busiest people around.

HARVESTING

by **Dilantha Gunawardana**

Rice production in Sri Lanka has a long and regal history—but the country faces steep challenges if its future is to be as bountiful as its past

The term "serendipity" was coined by author Horace Walpole in 1754 after reading an ancient fairy tale titled The three princes of Serendip. The word described the accidental discovery of fortunate things, after the many fortuitous findings by the story's heroes. The Arabic term "Serendib" (also spelled "Serendip") has been used to describe the island of Sri Lanka, regarded as an isle of unparalleled beauty and enumerable natural resources, since as early as AD 361.

Among the many natural blessings that mark Sri Lanka is vast, fertile terrain well suited for the growth of many crops, including rice, the staple food for the 21 million inhabitants of this South Asian nation. The importance of rice within Sri Lanka, however, extends well beyond its status as the primary food source, with integral roles in cultural identity, tradition, and politics.

Rice is grown primarily on irrigated land in Sri Lanka's "dry zone," an area spanning most of the country's north-central and northeastern regions, and secondarily on rainfed (nonirrigated) land by smallholder farmers across the county. In 2007, Sri Lanka's rice industry made up 5% of the nation's gross domestic product. Almost one-third of the labor force is directly involved in the rice sector. Currently, the per-capita consumption of rice is 108 kilograms per year. Although rice, until recently, offered minimal financial return for farmers, its social, cultural, and political significance has ensured that successive governments since independence have paid it due attention.

The current state of the rice industry in the Serendib isle is thus a story of sound research, investment in irrigation, and organized extension (technology dissemination) spanning two millennia. Over that time, the country has remained self-sufficient, or close to it, in rice. In recent times, however, the grail of self-sufficiency has proved somewhat more elusive, despite surplus years in 2004 and 2005.

The Sri Lankan rice industry can be traced back to the ancient kingdom of Anuradhapura, the first capital of this island nation, which flourished between 161 BC and AD 1017. Many ancient kings of this early kingdom developed large reservoirs and mazes of interconnected canals to irrigate the rice fields of their constituents. Reservoirs and waterways built by the kings of this golden era are to this day being used by rice farmers in the dry zone for irrigation. Many of these ancient works have been rehabilitated and maintained under the Mahaweli River diversion program, implemented during the 1980s to ensure reliable water availability.

A more recent renaissance of the rice industry can be sketched back to the establishment of the Rice Research and Development Institute (RRDI) in 1929 in Bathalagoda, a quaint rural town 110 kilometers northeast of the capital, Colombo. RRDI's successes include an improved variety, released in 1968, named Bg 11-11, which achieved yields of up to 8–9 tons per hectare. The 1970s and 1980s were dedicated to developing

SRI LANKAN FARM workers prepare to plant rice on a farm in Bathalagoda.

SERENDIPITY

DILANTHA GUNAWARDANA

high-yielding varieties resistant to a host of pests and diseases prevalent in Sri Lankan rice fields such as brown planthopper, bacterial leaf blight, rice blast, and rice gall midge.

Current research at RRDI concentrates on the development of higher yielding hybrid rice varieties, the effects of climate change on rice production, soil fertility and nutrient management, and weed control. Hybrid varieties in particular have received recent attention through a project supported by the Asian Development Bank, the International Rice Research Institute (IRRI), and the Food and Agriculture Organization (FAO) of the United Nations. Technical assistance is being provided by IRRI and the government of China. The FAO has also approved US$329,000 for hybrid rice development and popularization.

In 2007, the first modern commercial hybrid rice variety, Bg 407H, was developed at RRDI by a team led by senior plant breeder S.W. Abeysekera. Approximately 1,000 kilograms of Bg 407H seed was distributed island-wide. Able to achieve yields of up to 11 tons per hectare, Bg 407H is also resistant to rice blast and many natural pests, is salt tolerant, and possesses high grain quality, including long and strong grain body, favorable aroma, and short cooking time.

Since high-quality seed is crucial for hybrid rice farming, RRDI researchers have introduced a technique to improve seed germination without additional financial and labor costs. The method, termed "parachute sowing," involves placing seeds in specially developed trays possessing 434 wells, each 2 centimeters deep and filled with soil. One to three seeds are sown in each well and, 12 days later, the emerging plants are removed with the surrounding soil intact. The seedlings are then hand-sown into the field. The parachute-like appearance of the soil "cap" is responsible for the technique's name.

Over the past two decades, Sri Lanka has been able to produce more than 85% of the rice needed to feed its population. In 2004-05, favorable weather during both cultivating seasons—Maha (September to March) and Yala (April to August)—resulted in a national surplus. However, 10–15% of the country's rice has been routinely imported from Thailand, Vietnam, Myanmar,

A CLOSE-UP VIEW of "parachute" rice seedlings.

RRDI (2)

Bg 407H IS THE first commercially distributed modern hybrid rice variety developed by Sri Lanka's Rice Research and Development Institute.

RRDI (2)

A FARM WORKER holds stacks of 12-day-old rice plants ready to be sowed using the parachute method.

PARACHUTE RICE seedlings immediately after planting.

and, to a lesser extent, India.

Despite years of regal intervention, historical and modern infrastructure suited for year-round irrigation, efficient research, sound management and extension services, and gradual innovation, Sri Lanka was not immune to the global food crisis of 2008. Food and fuel prices have risen sharply and, combined with high government spending, caused inflation to hit a dangerous 28% in June 2008.

The effects of high prices for essential consumables are being felt by both urban and rural residents, the poorer of whom suffer from worsening malnutrition and susceptibility to disease. At the same time, higher prices have forced cutbacks in food aid and school meal programs. It is within this economic climate that both the Sri Lankan government and its national and international research and extension partners have initiated numerous programs to boost food production.

The Sri Lankan government has inaugurated a broad, multifaceted national program titled *Api wawamu rata nagamu*, which directly translates to "we cultivate and develop the country." The rice component of this program aims to increase production by 30% from 2008 to 2010. It is projected that 22.5% of the improvement will come from improving the productivity of existing rice varieties—to a national average of 5.2 tons per hectare from the current 4.3 tons per hectare—with the remaining 7.5% achieved through farming unused or abandoned cultivable lands. Other plans to improve rice production include the production of high-quality seed and the incorporation of higher-efficiency postharvest (drying, milling, and storage) technologies.

The FAO is also involved in the development of the rice sector in Sri Lanka in four key areas: reliable seed certification and efficient methods of seed dissemination; cultivation of 40,000 hectares of abandoned farmland mainly from the north-central and eastern provinces; production improvements in smallholder rainfed farms in

A RICE RESEARCH and Development Institute research center at Bathalagoda.

DILANTHA GUNAWARDANA

NASA

TOPOGRAPHICAL map of Sri Lanka.

the wet zone (in the country's southwest) by incorporating uncultivated or abandoned lands and boosting productivity through the implementation of efficient management practices; and better postharvest management to limit losses.

The first of these is a partnership between the public and private sectors, with the Department of Agriculture of Sri Lanka providing seed certification services and private companies, such as CIC Agri Business, contributing to seed dissemination. The contribution of the private sector to the Sri Lankan rice industry extends to the development of niche markets for rice and rice-based products—such as basmati rice, rice flour, and rice noodles—for both domestic consumption and export.

For Sri Lanka to reach, maintain, and even surpass self-sufficiency in rice production, a long-term vision, careful planning, innovative research, good management, and efficient extension services will be needed. Given its densely packed and fast-rising population, this tiny island needs to squeeze every bit of productivity out of its limited land area. Changing weather patterns, brought by global climate change, are bound to present an extra challenge in the coming years.

Time will reveal Sri Lanka's destiny as a rice-producing nation, a destiny that has been woven into the country's rice fields for more than 2,000 years. Rice production is in the hands of the current and next generations of rice scientists, agronomists, farmers, and politicians. Serendipity in the Serendib isle has relied on and always will rely on far more than mere good fortune.

Dr. Gunawardana, a Sri Lankan by birth, is a postdoctoral fellow at IRRI. *For assistance in researching this article, he acknowledges Dr. D.S.P. Kuruppuarachchi (assistant representative, FAO–Sri Lanka), Mr. S.W. Abeysekera (senior plant breeder, RRDI), Dr. W.M.W. Weerakoon (senior agronomist, RRDI), and Dr. W.M.A.D.B. Wickramasinghe (deputy director research and senior soil scientist, RRDI).*

ANURU ABEYSEKERA (*right*) and IRRI associate scientist Ofie Namuco look at promising rice varieties with potential to compete against weeds.

SANTO PANINGBATAN

WEEDING OUT WEEDS

Aside from water shortage and floods, weeds have become a major problem in the rice fields of Sri Lanka. More than 90% of farmers practice direct seeding in nonpuddled fields as opposed to transplanting seedlings into flooded fields. With the shift from transplanting to direct seeding, and without the protective layer of water, different hard-to-manage weed species have infested the fields. Weedy rice, in particular, has become a major threat to rice fields in different parts of the country.

Weedy rice is believed to be either a natural hybrid of cultivated (Oryza sativa) and wild rice species (O. rufipogon and O. nivara) or a result from the "de-domestication" of cultivated rice.

In Sri Lanka, weedy rice was first detected in 1992 but was not seen as a serious threat, says Anuru Abeysekera, senior weed scientist and head of the Plant Protection Division at the country's Rice Research and Development Institute (RRDI). Last year, however, in Ampara and Puttalam districts, many farmers complained that they could not cultivate their fields because of weedy rice, and yield losses were estimated at 30–100%. Now, RRDI is studying the longevity of seed viability of weedy rice seeds collected from different areas in Sri Lanka.

Dr. Abeysekera first began collaborative research with IRRI in the late 1990s with weed scientist Martin Mortimer. In 2004, she started working with David Johnson under the Irrigated Rice Research Consortium's (IRRC) Weed Ecology Work Group (now the Labor Productivity Work Group). Maintaining a strong partnership with the IRRC, in 2005-07, she conducted field surveys and experiments at RRDI, studied weedy rice, and compared crop-establishment and weed-control practices to reduce yield losses to weeds in different rice environments.

Dr. Abeysekera's philosophy is simple. "If the farmer is happy, reduces losses due to weeds, and gets a good yield," she says, "I have done my duty."

Rice crisis: THE AFTERMATH

What has happened, what has changed, and what are the challenges ahead?

by **Samarendu Mohanty**
Head, IRRI Social Sciences Division

Compared with the prices of other cereals such as wheat and maize, rice prices were relatively subdued for much of 2007. In late 2007, however, prices began to zoom upward to levels not witnessed in more than three decades. Between November 2007 and May 2008, export prices almost tripled (Figure 1). Since then, prices have softened but remain high.

Several factors such as adverse weather in key producing countries, high oil prices, and pro-ethanol policies combined with speculative trading and government trade interventions to control domestic prices contributed to the recent spike.

Despite media and public attention to the recent price surge, a steady increase in rice prices from 2000 went largely unnoticed. From 2001 to 2007, rice prices nearly doubled primarily because of a drawing down of stocks to meet the deficit arising out of deceleration in yield growth (Figure 2). Current global rice stocks have declined from a 135-day supply to a 70-day supply in the last 7 years—a 44% drop from 147 million tons in 2001 to 82 million tons in 2008.

Rice crisis aftermath

The 2008-09 rice market is likely to remain tight even with projected record global production of 432 million tons[1] (milled rice)—a 1% increase over last year's 428 million tons. Production in 2007-08, nearly 2% higher than the 2006-07 level of 420 million tons, was also a record.

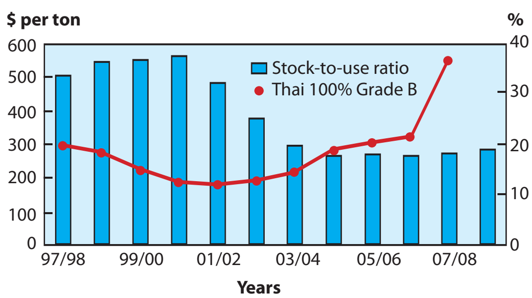


Fig. 2. Rice price and stock-to-use ratio.
Data source: Production, Supply, and Distribution Database and Rice Outlook Report, USDA.

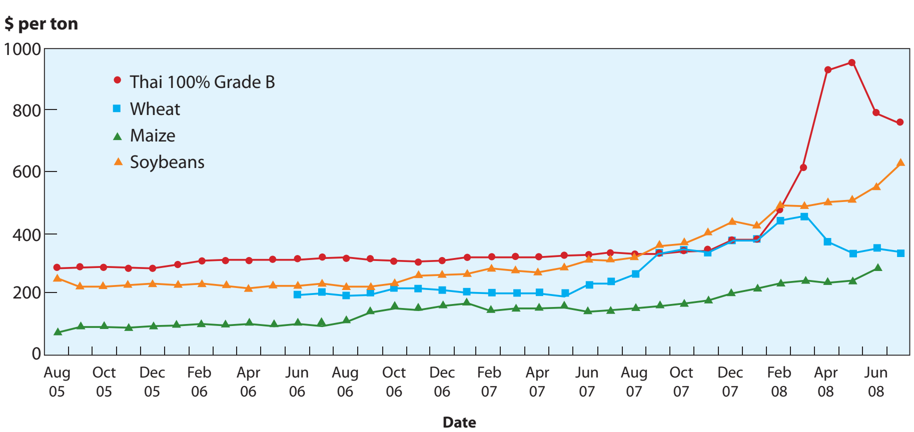


Fig. 1. Monthly crop prices.
Data source: various issues of Crop Outlook Reports, USDA.

The projected increase in global production is based primarily on increased area with average projected yield nearly unchanged from the previous year. According to the United States Department of Agriculture (USDA), rice area is projected to increase by almost 1 million hectares from 154.4 million hectares in 2007-08 to 155.3 million hectares in 2008-09. India will account for more than half of the total increase.

Despite higher prices, rice consumption is expected to remain strong because of substitution away from more expensive food such as fruits, vegetables, and livestock products. Global consumption in 2008-09 is projected to be around 426 million tons, an increase of around 1% from the previous year.

After reaching a record low of 73 million tons in 2004-05, global rice stocks have been steadily rising and are projected to reach 82 million tons in 2008-09, compared with 78.5 million tons in 2007-08.

Despite expectations that global stocks will continue to increase in the coming year, prices are likely to remain high partly in response to export restrictions imposed by key rice-producing countries. Making matters worse, already depleted stocks in the U.S.—one of the few countries that resisted imposing export restrictions during the recent crisis—are projected to decline further, further destabilizing the market in the coming months. However, as the bulk of the

[1] Production, Supply, and Distribution (PSD) database published by the United States Department of Agriculture (USDA).

2008 crop enters the market in October, prices may soften.

Long-term challenges

Despite some reassuring supply numbers for 2008-09, there are huge uncertainties regarding the source of future growth in global rice production. The annual rice yield growth rate has dropped to less than 1% in recent years, compared with 2–3% during the Green Revolution period of 1967-90.

Declining investments in all areas of rice research and infrastructure development (including irrigation) have been largely responsible for such dramatic slowing in yield growth. The same is not true for many other field crops such as maize, soybeans, and cotton, for which increased investment in the development of improved varieties and infrastructure has resulted in impressive yield growth.

Increasing rice production through area expansion is also unlikely in most parts of the world because of water scarcity and competition for land from nonagricultural uses such as industrialization and urbanization. World rice area has fluctuated between 145 and 155 million hectares over the past two decades, with the current level very close to the historic high. It would be prudent to assume that world rice area will remain in or even fall below this range in the next 10 to 15 years.

Changing consumption patterns

Global rice consumption remains strong, driven by both population and economic growth in many Asian and African countries. This is particularly true for most countries in sub-Saharan Africa (SSA), where high population growth combined with changing consumer preferences is causing rapid expansion in rice consumption. However, global average per-capita rice consumption has been flat for the last 5 years, with declining per-capita consumption in some countries (China, Thailand, South Korea, Japan, and Taiwan) offset by rising per-capita consumption in others (the United States, India, Vietnam, Myanmar, the Philippines, Bangladesh, and SSA countries).

In rapidly growing developing countries, income growth, urbanization, and other long-term social and economic transformations mean that consumer demand patterns are likely to move toward the consumption patterns of developed countries. A recent analysis by the International Rice Research Institute (IRRI) projects that, as the standard of living in the developing countries rises in the future, overall per-capita consumption will decline slightly from 64 kilograms in 2007 to 63.2 kilograms in 2020. Among major rice-consuming countries, both Chinese and Indian per-capita consumption during this period is projected to decline by 4.2 and 3.5 kilograms, respectively (Figure 3). Nevertheless, even with such a decline in per-capita rice consumption, total consumption in these two countries is projected to increase by 18 million tons because of population growth.

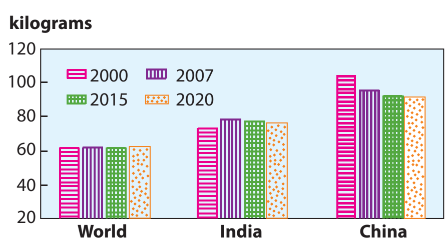


Fig. 3. Per-capita rice consumption.

Overall, China's and India's share in total world consumption is projected to fall from 52% in 2007 to 49% in 2020. The decline in per-capita consumption is also projected to continue in Japan, South Korea, Thailand, and Taiwan. For many other countries, including the Philippines, Myanmar, Bangladesh, Malaysia, Saudi Arabia, and many African nations, per-capita consumption is projected to increase over the same period. An increase in per-capita consumption is also projected for many developed countries in North America and the European Union because of immigration and food diversification.

Overall, 59 million tons of additional milled rice—equivalent to around 89 million tons of paddy (unmilled) rice—will be needed by 2020 above the 2007 consumption of 422 million tons (Figure 4). However, 2020 consumption projections may go even higher if prices of other food items (livestock products, fruits, and vegetables) remain high, causing slow progress in diet diversification in developing countries.

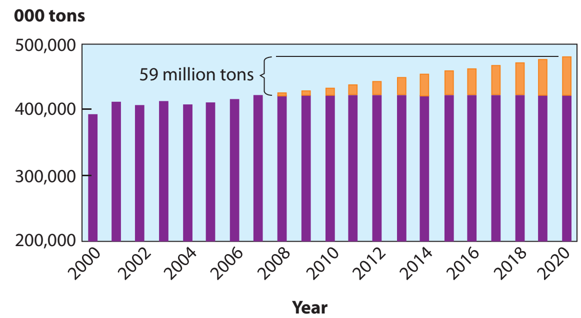


Fig. 4. Total milled rice consumption.

What does this mean for IRRI?

The current crisis serves as a timely wakeup call for governments, multilateral organizations, and donors to refocus on agriculture. Various national and international bodies have called for a second Green Revolution to feed the world in the face of a growing population and shrinking land base for agricultural uses.

Unlike the first Green Revolution, in which productivity growth was achieved with the introduction of modern varieties in tandem with assured irrigation and inputs (such as fertilizer), and guaranteed prices, the second Green Revolution needs to achieve the same goal in the face of several 21st-century challenges. These challenges include water and land scarcity, environmental degradation, skyrocketing input prices, and globalized marketplaces. In short, the second Green Revolution will have to expand productivity in a sustainable manner with fewer resources.


BY ACHIM DOBERMANN & DAVID DAWE

CAN ORGANIC AGRICULTURE FEED ASIA?

Rising fertilizer prices and misperceptions about environmental degradation in intensive agriculture have stimulated claims that so-called "low-input" technologies relying on organic nutrient sources may provide a more sustainable means of producing food crops and increasing farmers' income. However, the sole use of organic technologies would likely perpetuate food insecurity and poverty in Asia because they are typically an expensive source of essential nutrients and confer few if any benefits in terms of sustainability and the environment.

> CEREAL PRODUCTION IN ASIA WILL DEPEND PRIMARILY ON MINERAL NUTRIENTS TO MEET FUTURE DEMAND

The effects of organic matter applications on soil quality and crop yields become clear only after several years of continuous applications. Numerous long-term experiments conducted in a wide range of rice-based cropping systems have demonstrated that the continuous use of organic amendments, at affordable rates, does not lead to significant yield advantages compared with systems that are managed with judicious and balanced use of mineral fertilizers.

Organic practices can result in nutrient imbalances (both excesses and deficiencies). Short-term yield reductions are common and organic agricultural systems appear to require both premium prices and government subsidies to remain economically viable on a large scale. They also require large amounts of organic nitrogen (N) sources or diversion of land to accommodate rotations with leguminous crops (green manures) that can capture atmospheric nitrogen.

Diverting land to grow nonfood or low-yielding leguminous crops reduces food production. This may be feasible in some industrialized countries, but, in developing countries with high population densities and limited agricultural land, it can threaten national food security and poverty reduction by leading to higher food prices. Moreover, recent research suggests that there are no proven environmental benefits in organic systems, such as less N leaching or lower gaseous-N losses, when the environmental impact is expressed on a per ton food-produced basis.

In all cropping systems, nutrients are constantly removed in the form of crops harvested. If these nutrients are not returned, the system cannot be sustainable without further input from outside. Organically managed systems are no exception to this rule. Organic fertilizers produced within the boundaries of a farm do not add nutrients to the cropping system as a whole; rather, they transfer nutrients within the system. In contrast, mineral fertilizers add nutrients to the system. In most low-input systems that rely on organic sources, the nutrient content and quantity of available organic fertilizers are insufficient to achieve high yields for most crops.

Irrigated rice, with its flooded fields, is the only major food crop that can achieve stable yields with up to three harvests annually, without the need for rotation, for decades. Unique features of carbon and nitrogen cycling in submerged soil mean that soil organic matter actually tends to accumulate in such systems, even if no manure is applied or much of the rice straw is removed from the field. In such systems, applying organic matter in addition to crop residues has relatively less benefit for either crop productivity or the sustainability of the overall cropping system.

Because the environmental and sustainability benefits of organic fertilizer in rice production are small or nonexistent, use of organics should be governed by profitability. But the nutrient content of organic fertilizer is typically low and much more variable than that of inorganic fertilizer, necessitating large quantities. Thus, if organic fertilizer needs to be transported over a long distance, costs can be prohibitively high. Further, given organic fertilizer's variable nutrient content, farmers often have trouble judging how much to apply. With inorganic fertilizer, farmers are relatively sure of the nutrient quantities and can more easily adjust nutrient rates and proportions to match site-specific needs.

When manure or other organic materials are readily available, rice farmers should apply them as part of their overall management strategy. For example, applying organics in a primitive production system that does not use mineral fertilizers will probably increase profits and food production. But, most Asian rice farmers already use mineral fertilizer, so higher profits are likely only if organics are used to supplement—not replace—conventional inorganic fertilizers.

Many commercially produced organic fertilizers that are widely promoted and even subsidized in rice-growing countries of Asia do not provide proven profitable yield gains. Although high fertilizer prices have added additional pressure to farmers and policymakers alike, governments should limit subsidies and invest instead in technologies that, coupled with appropriate supporting policies, enable farmers to improve yields and fertilizer efficiency in their fields.

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