



RiceToday

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International Rice Research Institute

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Official publication of
International Year of Rice 2004

Rice year updates:
Festivities in Asia mark
International Year of Rice

World food reprise:
Des Moines puts rice
back on the menu

The whole way:
Going the distance
for the environment

RICE REVEALED
Riceworld's decade of celebrating the life-giving grain

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IRRI

Rice
Science
for a Better
World



The rice that feeds

Asia's poorest is also their

biggest single expense,

so cheap rice means more

money for other essentials

such as education



Rice is
Life

INTERNATIONAL YEAR OF RICE 2004

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Proud to lead the way




The world was a terrifying place in 1952-53. The period saw the first use of “population explosion” in *Time* magazine and — a cruel irony — the first detonation, over the Pacific Ocean, of a hydrogen bomb. It also brought across the Pacific two senior Rockefeller Foundation agriculturalists to study how to end 2 decades of stagnating rice yields in Asia. By 1960, the population explosion was a cover story in *Time*, and the International Rice Research Institute (IRRI) was established in the Philippines to shore up global food security in the face of exponential population growth.

Along with the other midwife of the Green Revolution, the Mexico-based International Maize and Wheat Improvement Center, IRRI was a prototype for a global network of research centers that, since 1971, have found common purpose within the Consultative Group on International Agricultural Research. With more than US\$400 million in annual funding from its 63 cosponsors and member states and organizations — in particular the World Bank and developed countries in North America, Europe and the Asia Pacific — the 15-center group represents the world’s largest investment in mobilizing science to generate public goods for poor farm communities.

Since IRRI’s release in 1966 of the first modern rice variety, the institute has led the way in developing improved rice cultivars and other agricultural technologies to benefit Asia’s 200 million rice farmers and the billions of rice consumers who

depend on them for reliable, affordable supplies of their staple food. IRRI’s work, on its research campus at Los Baños and across Asia in collaboration with the national partners it has nurtured, has greatly contributed to the near doubling of the Asian rice harvest since 1970.

Today, the institute combines rice-biodiversity conservation, gene discovery and plant breeding with natural resource management, integrated pest management, agricultural engineering and postharvest technologies, and social and policy studies to develop ecologically and economically sustainable strategies to reverse a troubling new stagnation in rice-yield improvement. This trend occurs in the contexts of slowing population growth and Asian farmers enjoying an average yield more than double that of their parents and grandparents at IRRI’s founding. It nevertheless threatens to undermine the indispensable agricultural foundation of development, thus sabotaging the prospects of today’s 500 million poor in rice-producing Asia and a large portion of the billions to be born in the several decades before the global population finally stabilizes.

People at IRRI take pride in how they, their colleagues and their predecessors going back to the shell-shocked middle of the 20th century have helped to make the world a more prosperous, safe and hopeful place. But much remains to be done to achieve the United Nations Millennium Development Goals and so alleviate hunger, want, preventable disease, ignorance, inequality and environmental degradation. With continued support, IRRI’s 1,000 scientists, administrators, support staff and contract workers will contribute much more than their share. 



Agricultural research investments pay

by Pratima Dayal

The Asian Development Bank is dedicated to reducing poverty and improving people's welfare. The 63-member ADB pursues these goals with diverse operations in agriculture and natural resource management, energy, finance, industry, social infrastructure, transport, and communications.

In 1999, ADB defined its vision of an Asia-Pacific region free of poverty and formulated a *Poverty Reduction Strategy* focused on sustainable economic growth, inclusive social development and good governance. In early 2001, it adopted a *Long-Term Strategic Framework* to provide a roadmap for action up to 2015. The framework is well aligned with the United Nations Millennium Development Goals and firmly grounded on the key operating principles of strong country ownership, strategic partnerships and development impact assessment.

Substantial and sustained support

From its establishment in 1966, ADB has recognized how agriculture, natural resources and environment are intertwined with the lives of the rural poor in Asia, and so has provided substantial and sustained support in these areas. Between 1968 and 2003, ADB approved 566 loans — constituting 17% of approved loans and totaling US\$18 billion — for agriculture, natural resources and rural development. This sector has also been a major recipient of ADB technical assistance (TA) grants, attracting 26% of all such grants between 1967 and 2003, which amounted to \$497 million.

ADB has a long-standing partnership with the Consultative Group on International Agricultural Research (CGIAR), recognizing much in common between the missions of the CGIAR and ADB in improving agricultural productivity, conserving soil and water resources, protecting genetic diversity, and bolstering human resources. Agricultural research continues to be relevant to ADB operations and development objectives as a means of reducing poverty in Asia.

From 1975 to 1995, ADB channeled

its financial support to the CGIAR largely through individual grants to specific centers for specific purposes, which ranged from improving training facilities to establishing regional collaborative networks. Following Board approval of the ADB policy paper on agriculture and natural resources research (ANRR) in 1995, support for this sector has been channeled through annual umbrella regional technical assistance (RETA), with eight approved grants to date totaling \$38.5 million.

ADB's policy on ANRR addresses three strategic objectives: sustainable management of natural resources, improved agricultural productivity and poverty reduction. With ADB linked to farmers and local stakeholders through its partnerships with international agricultural research centers and national agricultural research systems, the bank ensures that technology is simplified into understandable language and procedures, knowledge is disseminated and institutionalized, and community participation encouraged.

The International Rice Research Institute (IRRI) is the CGIAR center that has received the most ADB support, starting with the bank's first TA project with a CGIAR center, a grant in 1975 to buy equipment for the IRRI Training Center. Since that year, ADB has supported 22 IRRI-led projects. Other main TA recipients have been the International Crops Research Institute for the Semi-Arid Tropics, International Water Management Institute, and WorldFish Center. Altogether, 14 international agricultural research centers have enjoyed ADB support.

Comprehensive guidelines

ADB's project-based support to the CGIAR has gone hand-in-hand with efforts to improve the focus and quality of that research. In April 2003, the bank formulated comprehensive guidelines for submitting and evaluating proposals under the annual ANRR RETA. Following procedures detailed in the guidelines, the final selection of projects for the eighth such grant resulted from one of the most in-depth consultations ever carried out within ADB regional departments.



MS. DAYAL is a senior agriculture specialist in the Agriculture, Natural Resources and Social Sectors Division of ADB's Regional and Sustainable Development Department.

To promote dialogue and cooperation among national agricultural-sector managers, national and international research institutions, and donors, the bank is this year facilitating two regional forums on ANRR, in Central Asia in August and in South Asia in September. The forums will highlight significant achievements and benefits resulting from research funded by ADB and other donors, as well as strengthen linkages among donors, country programs and research outputs.

ADB's experience in development assistance shows that agricultural research pays a handsome return in terms of alleviating rural poverty, promoting rural productivity, employment and sustainable natural resource use, and improving incomes and living standards. ADB will continue to serve as an impartial adviser to agricultural development and a broker assisting efforts that strengthen cooperation toward sustainable economic growth and development through agricultural research and extension.

Cooperation with Korea advances in conference rooms and laboratories

Collaboration between IRRI and the Korean Rural Development Administration (RDA) took another step forward at the 19th RDA-IRRI Collaborative Research and Training Workplan Meeting at IRRI on 19-20 April. Participants assessed the progress of collaboration in 2002-03 and developed a 2004-05 RDA-IRRI collaborative workplan, including new project proposals. The meeting also highlighted the achievements of 40 years of Korea-IRRI partnership on rice research and development.

Meanwhile, breeding collaboration

between IRRI and the RDA at the National Institute of Crop Science (NICS) in Suwon, South Korea, has made progress against a serious pest problem of japonica rice by successfully developing brown planthopper-resistant japonica rice breeding lines.

A new source of resistance to brown planthopper was identified in two IRRI breeding lines and incorporated into two japonica rice cultivars, *Jinbubyeo* and *Junambyeo*, using conventional and molecular breeding methods. These research materials will be shared with scientists

working in two other NICS-affiliated institutes, the Honam Agricultural Research Institute and the Yeongnam Agricultural Research Institute, for their breeding programs to improve japonica resistance to brown planthopper.



AILEEN DEL ROSARIO-RONDILLA

SHAKING HANDS after the signing of the 2004-05 RDA-IRRI collaborative workplan are Moon-Hee Lee (left), director general of the Korean National Institute of Crop Science (NICS) in Suwon, South Korea, and Ren Wang, IRRI deputy director general for research. Looking on are (from left) William Padolina, IRRI deputy director general for partnerships; K.L. Heong, deputy head of IRRI's Entomology and Plant Pathology Division (EPPD); Nollie Vera Cruz, EPPD senior scientist; Jae-Kweon Ko, senior rice breeder at Honam Agricultural Research Institute; Sant Virmani, IRRI principal scientist in plant breeding; Darshan Brar, senior scientist in IRRI's Plant Breeding, Genetics and Biochemistry Division (PBGB); Mark Bell, head of IRRI's International Programs Management Office (IPMO); Ho-Yeong Kim, EPPD senior scientist; Hung-Goo Hwang, director of the Breeding and Genetics Division of NICS; Ji-Ung Jeung, senior research scientist in the IRRI-Korea Office; K.K. Jena, PBGB senior scientist and IRRI country representative for Korea; Tom Mew, IRRI principal scientist in plant pathology; and Jojo Lapitan, IPMO senior scientist.



EGYPT GOVERNMENT

DR. LEE (center) examines plants with resistance to brown planthopper. With him are Hung-Goo Hwang (left), director of the Breeding and Genetics Division of NICS, and K.K. Jena, IRRI country representative for Korea.



JU-UNG JEUNG

Briefly

Rice Today uplifted

Hong Kong Dragon Airlines is marking International Year of Rice 2004 by offering *Rice Today* in its airport lounge and first and business class cabins on all routes. Dragonair operates 20 passenger aircraft between Hong Kong and 28 other Asian destinations, including Beijing, Taipei, Phnom Penh, Bangkok and Tokyo. This is perhaps the first time that an airline anywhere has stocked a research institute newsletter alongside the usual gossip magazines and international news and business weeklies.

Rice Knowledge Bank in Nepal

The Nepal Agricultural Research Council (NARC) and IRRI held on 28 April an orientation workshop for establishing the Nepal country site of the Rice Knowledge Bank. The Knowledge Bank provides practical

rice knowledge and training materials that help rice researchers and extension workers better meet farmers' needs. It promises to become a repository for current rice knowledge relevant to the various agroecologies of Nepal, with information accessible through the Internet, on CD or in print.

Plant breeding team honored

IRRI's Plant Breeding, Genetics and Biochemistry Division breeding team was recognized at the 28 April Annual Rice Varietal Improvement Group meeting of the Philippine National Seed Industry Council. The team was honored for the Philippine release in 2003 of two new rice varieties for the irrigated lowlands — *Matatag 3*, which is resistant to rice tungro virus, and *Angelica*, which is high-yielding and has good resistance to bacterial leaf blight.

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Rice with that?

Fast-food chain McDonalds is showcasing *Graindell*, IRRI's book for children, in its current Bright Minds Read campaign, which started in April at all 241 of its outlets in the Philippines. McDonalds launched the campaign to "empower the Filipino child through encouragement and promotion of reading as a fun and enjoyable activity for growth in mind, character and values." IRRI is one of three publishers that McDonalds invited to participate in the reading and literacy campaign.

Scientific excellence recognized

Ten scientists from Africa, Latin America and Asia were recognized in May by the International Fund for Agricultural Research, a foundation dedicated to fostering scientific excellence in agriculture through

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IRRI DIRECTOR GENERAL
Ronald Cantrell (left)
with Egyptian Deputy
Prime Minister Youssef
Wally.

ber 1998 and led the institute through many major challenges and decisions.

“Ron Cantrell provided the steadying hand, strong leadership and intelligent management IRRI needed,” said Dr. Otsuka. “The institute went through an uncertain period in the mid- to late-1990s, with one director general departing unexpectedly to be replaced by a temporary appointment. But, within a year or so of his arrival, Dr. Cantrell had got the institute back on track.”

After successfully negotiating a tumultuous start, Dr. Cantrell had to deal with two of the biggest challenges fac-

ing agricultural research in the developing world. A continuing decline in funding hit IRRI hard in 2002, when Japan cut its financial support by almost 50%, causing painful staff cutbacks. Added to this was the growing international debate over biotechnology and how it could be used to benefit poor rice farmers and consumers.

Dr. Otsuka emphasized that IRRI now needed to find new candidates of Dr. Cantrell's caliber. “We especially want to encourage good candidates with outstanding expertise in rice science and who fully understand the international rice industry,” he said. “The position is one of the most important and influential in the rice industry today.”

• Other topics raised by Dr. Otsuka following the 29 March-2 April board meeting included the board's acknowledgment of the favorable External Program and Manage-



INTO EGYPT. IRRI Board of Trustees Chair Keijiro Otsuka and Director General Ronald Cantrell (first row, fourth and fifth from left) pose with principal rice researchers at the Rice Research and Training Center at Sakha, Egypt. Drs. Cantrell and Otsuka also met with Egyptian Deputy Prime Minister Youssef Wally, who also serves as minister of agriculture and land reclamation, during an 8-12 May visit to Sakha and the Rice Technology Training Center in Alexandria. Dr. Wally and Badawi A. Tantawi, head of the Egyptian Rice Research Program, expressed appreciation for IRRI's contributions to the tremendous increase in rice production in Egypt, where the average yield climbed from 5.4 t/ha in 1970 to 9.2 t/ha in 2003, one of the highest yields in the world.

ment Review in March and his assessment of IRRI's financial situation, about which he was cautiously optimistic. He also welcomed three new board members — Ruth K. Oniang'o (Kenya), Ronald L. Phillips (USA) and Baowen Zhang (China) — and bid farewell to three departing members: Calvin Qualset (USA), Mike Gale (U.K.) and Emanuel Serrão (Brazil).

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the Consultative Group on International Agricultural Research (CGIAR). The successful scientists, who will spend up to 3 months working with world-class researchers at CGIAR centers, are Helga Rodriguez Von Platen, Christian O. Thine, Zachee Ngoko, Xue-Jun Ge, Jules Bayala, Geetha Rani, Peter Gathumbi, Tilahum T. Habtemichael, Drissa Hema and Reuben Muasya.

Award for Bangladesh video project
The Poverty Elimination Through Rice Research Assistance communication project “Learner-centered video production to enhance women-to-women extension of postharvest innovations” in Bangladesh received a Bronze Award for effective communication from the International Visual Communications Association at a ceremony in London in March.

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Step forward for biodiversity

Cape Verde and Egypt became on 1 April the first governments to sign the agreement to establish the Global Crop Diversity Trust. The trust, which aims to raise US\$260 million from governments, foundations and corporations, will provide a permanent source of funding for collections of crop diversity around the world. This diversity is an essential source of the traits scientists need to adapt crops to farmers' food and livelihood needs and to changing environmental conditions.

IRRI scientists at grains confab

Several IRRI scientists featured at the 18-19 March 4th National Grains Postproduction Conference in Cebu City, Philippines, organized by the Philippine Rice Postproduction Consortium, of which IRRI is a founding

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member. IRRI speakers included Swapan Datta (on Golden Rice research), David Dawe (rice marketing in the Philippines), Martin Gummert (IRRI's postharvest priorities), Cristina Sison (rice biofortification) and Eugene Aquino (developing a low-cost moisture meter). A forum on concerns in Philippine grain postproduction identified lower costs, simple designs and efficient drying as key farmers' needs.

More rice for less water

A new Australian method for selecting low water-use soils for rice production and reduced risk of salinity is being adopted by rice farmers. The approach, developed by the Cooperative Research Center for Sustainable Rice Production, uses electromagnetic induction to create a picture of the soil to a depth of 5 meters or more, combined



PROJECT MANAGEMENT IN BHUTAN: International Programs Management Office Senior Scientist Jojo Lapitan (front row, third from left) led a project-management course on 27-29 April in Wangduephodrang, Bhutan. Providing technical assistance toward developing Bhutan's research and human resource capacity, the course was attended by 16 senior Bhutanese research and administrative officers from renewable natural resources research centers, watershed projects and the Natural Resources Training Institute.



AWARD-WINNING FARMERS: The Vietnamese Ministry of Agriculture and Rural Development promoted in April the Three Reductions farming technique — locally known as Ba Giam Ba Tang — by honoring farmers who produced crops with the lowest inputs and highest output, thus maximizing profits. The campaign, which encourages farmers to reduce their seed, pesticide and fertilizer rates, has spread to thousands of farmers in the Mekong Delta through radio, TV, posters and leaflets.

Postharvest project for Cambodia and Vietnam

The Asian Development Bank has approved a US\$750,000 Japanese Fund for Poverty Reduction grant for a project to reduce postharvest losses on rice farming in Vietnam and Cambodia. The project aims to develop a comprehensive training package in cost-effective postharvest methods that will improve food security, boost livelihoods and reduce poverty in villages that rely on rice production.

The training will be provided to three farming intermediary institutes in each country. The institutes will work with at least 800 farmers and 10 rice millers to teach drying and pesticide-free storage techniques and improve rice-milling techniques. Spoilage caused by poor storage techniques can rob farmers in Vietnam and Cambodia of half or more of their household grain supplies.

The Vietnamese and Cambodian governments will together contribute \$25,000 in kind to fund the project, and IRRI — the executing agency for the grant, which can be utilized until 2006 — will add \$165,000 in kind, for a total of \$940,000. IRRI-developed equipment will be adapted using locally available materials to ensure that it is affordable to farmers, and farmers and rice millers will be taught about the workings of the local rice market, including consumer preferences, quality requirements and pricing mechanisms.

Correction: A photo caption on page 25 of the April-June issue of *Rice Today* misidentified V.N. Singh as H.N. Singh.

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with evaluation of soil chemical properties. The technique helps farmers minimize the amount of irrigation water escaping into the groundwater system.

Library capacity building

IRRI librarians Carmelita Austria, Lea Delos Reyes and Mila Ramos trained librarians at a capacity-building workshop on 20-21 May at Benguet State University, Philippines, for PhilAgriNet, a network that aims to build a central database of Philippine technical agricultural literature outputs, and the International Information System for the Agricultural Sciences and Technology (AGRIS).

Science Council meeting

The new Science Council of the Consultative Group on International Agricultural

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Research, IRRI's parent group, held its formal inaugural meeting on 12-15 May at the International Center for Agricultural Research in the Dry Areas, Syria. Chaired by Per Pinstrup-Andersen, former director general of the International Food Policy Research Institute, the council consists of Virender Lal Chopra, Ken Fischer, outgoing IRRI board member Michael Gale, Richard Harwood, Alain de Janvry, Keiji Kainuma, Onesmo ole-Moi Yoi, Lisa Sennerby-Forsse and Hans Gregersen.

Pest management on CD

IRRI and the Malaysian Agricultural Research and Development Institute jointly implemented in May a CD-based training course on integrated pest management (IPM) for research and extension personnel in Malaysia. This type of training, based

on information in IRRI's Rice Knowledge Bank, allows the institute to reach more participants with fewer resources. The course was structured around the themes of ecology, updates on pest management practices, sociology, and the communication and implementation aspects of IPM. The training was mostly CD-based, and only a few topics were delivered in face-to-face lectures.

Indian transgenic crops

The Indian Council of Agricultural Research (ICAR) will develop transgenic varieties of 14 selected crops, including rice resistant to stem borer and fungal infections. Other crops slated for development include stem borer-resistant sorghum and maize and pod borer-resistant pigeonpea and chickpea. At the March national conference on

New logo and awards for communicators



The Philippine chapter of the Association for Communication Excellence in Agriculture, Natural Resources, and Life and Human Sciences unveiled its new logo in May, as IRRI staff won a swag of awards in the U.S.-based association's 2004 Critique and Awards Program.

Aurora Ammayao and husband Gene Hettel won a Gold Award and the Outstanding Professional Skill Award in writing for their chapter in the book *Art of Rice: Spirit and Sustenance in Asia*, published by the UCLA Museum of Cultural History (an adapted excerpt of the chapter appeared in the January 2004 issue of *Rice Today*); Ariel Javellana, Christian Concepcion and Duncan Macintosh won a Gold Award for IRRI's International Year of Rice poster set; Meg Yandoc, Gina Santos, Vic Alarcon, Joe Ibabao and Gene Hettel won a Silver Award for the *IRRI Bulletin* electronic newsletter; and Juan Lazaro IV, Ariel Javellana and Gene Hettel won a Bronze Award for an IRRI Rice Image Bank advertisement.

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transgenics in agriculture, ICAR Director General Mangala Rai said that the council will move ahead with transgenic crops following Planning Commission approval.

All about rice

The Asia Rice Foundation launched in February *All About Rice*, a new quarterly publication designed to enlighten readers about topical rice issues. The first edition focuses on *Organic Fertilizer in Rice: Myths and Facts*. The editors encourage submissions, which should provide information that will help readers understand specific issues, mobilize public support and increase appreciation for rice. Send submissions and queries to: The Asia Rice Foundation, Los Baños, 4031 Laguna, Philippines; tel/fax (+63-49) 536-2285; email asiarice@laguna.net. Visit the foundation at www.asiarice.org.

RICE IN THE NEWS

New York Times calls for a 'gene revolution' for the poor

An editorial in the 24 May edition of the *New York Times* welcomed a statement in the 2004 annual report of the Food and Agriculture Organization of the United Nations that genetically modified foods are safe to eat. It repeated the report's main conclusion regarding "the real problem with genetically modified crops: they are not aimed at helping the world's hungry."

The editorial continued: "Agriculture is the livelihood of 70% of the world's poor, a population that is growing considerably, even as soil and water are becoming depleted. Billions are already malnourished because their staple crops supply few nutrients. Genetic engineering can help on both counts."

"The poor need a 'gene revolution' to follow the 1960s Green Revolution, which helped hundreds of millions by increasing the yields of wheat, rice and other crops. But so far, there's only been a gene revolution for agribusiness. The genetically engineered food industry is controlled by a few corporations, such as Monsanto and DuPont. They have little incentive to work on crops poor people grow, or to share their licensed technology."

To allow widespread research on poor-country crops, these companies must release the technology for humanitarian use.... Wealthy countries must sponsor research...."

• The 13 March edition of *The Hindu* newspaper reported on a public debate on "Biotechnology and shaping the future of rice," held in Chennai, India, the previous day by the M.S. Swaminathan Foundation (www.hindu.com/2004/03/13/stories/2004031311740500.htm). It said debaters achieved a consensus that "thorough discussion on various aspects of genetically modified seeds and food should be held before a final decision on adopting the new GM technology is taken." Panelists supporting the use of biotechnology for improving crops' nutritional value and resistance to pests and disease were M.K. Bhan, secretary of the Indian government's Department of Biotechnology; William James Peacock, chief of the Australian Commonwealth Scientific and Industrial Research Organization; and Gerard Barry, IRRI-based coordinator of the Golden Rice Network. Suman Sahai, president of the Delhi-based NGO Gene Campaign, dissented.

Canberra Times considers security role of rice research

Keijiro Otsuka, chair of IRRI's Board of Trustees and vice president of the International Association of Agricultural Economists, warned in an editorial published on 1 April in the *Canberra Times* that alleviating rural poverty in Asia and quelling the instability it causes requires revitalized donor support for publicly funded rice research.

"Rice directly or indirectly supports hundreds of millions of people, so improving farmers' ability to grow rice efficiently and sustainably is essential for ensuring food security, alleviating poverty and improving the well-being of rural and urban populations alike," wrote Dr. Otsuka, adding that the potential for success is greater than ever.

"The recent sequencing of the rice genome is now providing more scientific knowledge of the rice plant than has been gathered in the 15,000 years of its cultivation," he said. "The development of more nutritious rice varieties promises to help combat the malnutrition that afflicts hundreds of millions of people who depend on rice for most of their calories. However, declining support is preventing the delivery of new technologies to farmers."

Meanwhile, in the edition of *Paddy and Water Environment* published online on 25 February, IRRI Director General Ronald P. Cantrell addressed the challenges and op-

portunities for rice-based farming in the International Year of Rice and beyond.

"There are two major challenges involving rice in Asia," he wrote. "The first is ensuring the ability of nations to meet their national and household food security needs with a declining natural resource base, especially regarding water and land. [...] The second challenge — as stated by the UN as one of its eight Millennium Development Goals — is the eradication of extreme poverty and hunger. Rice is so central to the lives of most Asians that any solution to global poverty and hunger must include research that helps poor Asian farmers earn a decent, reliable income by growing rice that is affordable to poor consumers."

Dr. Cantrell noted that "stiffer competition from industrial and domestic users for limited water supplies is creating an urgent need to improve crop water productivity. About 70% of the water currently withdrawn from all freshwater sources worldwide is used for agriculture. In Asia, irrigated agriculture uses 90% of the total diverted freshwater, and more than half of this irrigates rice. Until recently, such water usage has been taken for granted, but this cannot continue. We must help farmers produce the larger harvests required by future generations while using no more water than they use today, and probably less."

Harvest shortfalls and higher grain prices viewed as a worrying trend

Meager grain harvests over the past several years, especially in China, are raising a chorus of concern that the relative bounty of recent decades may soon be a thing of the past. The *New York Times*, *Asian Wall Street Journal*, *Asia Times*, and *Globe and Mail* are among the newspapers that since March have published major features suggesting structural causes for declining grain harvests, diminished stocks and soaring prices.

Lester Brown, founder of the Worldwatch Institute and the Earth Policy Institute (www.earth-policy.org), has long warned of global famine. Lately, more people seem to be listening. Martin Mittelstaedt, writing in the 22 May edition of Canada's prestigious *Globe and Mail*, said the American "media magnate Ted Turner came upon [Brown's] new book [*Plan B, rescuing a planet under stress and a civilization in trouble*] and thought its worrisome content was so persuasive that he bought more than 3,000 copies for distribution to people he knows."

Mittelstaedt reported that total global grain reserves stood at 280 million tons in late 2003, down from more than 500 million tons in 1999. Citing Brown, he blamed "three main environmental trends ... : global warming, water shortages in many parts of the world and farmland degradation in China."

Factoring in economic causes, reports attributed the decline in land sown to grain in China to urbanization, desertification and reforestation efforts to combat it, loss of irrigation supplies, a shift to higher-value crops, and a decline in double-cropping due to farm labor shortages.

The *Asian Wall Street Journal* reported on 9 March: "Sudden price surges for China's most precious staple, rice,

have caught several big cities off guard and prompted urgent measures to ensure supply." Among them was a government pledge of "\$1.2 billion in rural subsidies to get farmers to grow more grain" and work to "smooth supply bottlenecks."

Jim Yardley, writing in the 2 May edition of the *New York Times*, focused on often illegal land conversion in China. "Since 2002, China has lost more than 13,500 square miles [3.5 million ha] of farmland," he wrote. "Last year alone, more than 2% of all farmland was lost."

Citing farm-gate and world-market price declines that are "driving thousands from an increasingly unprofitable business," Alan Boyd noted in a March edition of the *Asia Times* that global rice stocks "are ex-

pected to decline by 20 million tons, reducing reserves to about 3 months of supply. China and India, the biggest consumers, will experience the largest drops."

Mittelstaedt was especially alarmed at the effect of global warming on plants' ability to fertilize their seeds. He cited research conducted at IRRI that "found that the fertilization of rice seeds falls from 100% at 34 degrees to near zero at 40 degrees."

"It's the work that we have been doing with colleagues at the University of Florida, Gainesville," commented John Sheehy, specialist in crop ecology and crop modeling, when he saw the article. "The bit that gets left out is that we're trying to work on a solution to the high-temperature problem, but finding it almost impossible to get funds."

Cooperation in South Asia on zero tillage, basmati promotion

The 10 March edition of the *Financial Express* newspaper in India and the 29 March online edition of the *Daily Times* newspaper in Pakistan covered an agreement by subcontinental rivals India and Pakistan to cooperate in soil-conservation technologies and sustainable agriculture.

The stories cited Mangala Rai, director general of the Indian Council of Agricultural Research (ICAR), saying that the regional meeting of the IRRI-supported Rice-Wheat Consortium in Islamabad in February had "paved the way for bilateral cooperation between the two countries" after 8 years of stymied progress in the consortium due to "adverse political relations." The agreement calls for bringing 1 million ha, including 900,000 ha in India, under zero tillage.

Ashok B. Sharma, author of the *Financial Express* article, followed it up on

14 March with a report that the Rice Exporters Association of Pakistan and the All India Rice Exporters' Association had agreed in New Delhi to jointly promote exports of basmati rice (www.financialexpress.com/fe_full_story.php?content_id=54749).

"We will jointly fight any possible infringement on geographical indications on basmati rice, which is our common heritage," Sharma quoted Abdul Rahim Janoo, head of the Pakistani delegation, as saying. "We will also jointly promote basmati in the overseas market." India and Pakistan together export more than 1 million tons of basmati rice per year.

Sharma urged in the next day's *Financial Express* similar promotion and protection for other scented South Asian rice varieties (www.financialexpress.com/fe_full_story.php?content_id=54785).

Also...

Christopher Surridge, a senior biology editor of *Nature*, investigated in the 25 March edition of the journal (Vol. 428) the controversy surrounding the **system of rice intensification (SRI)**. "In some ways, the debate resembles that currently raging over organic agriculture," he wrote. "For advocates, SRI is a grassroots movement to resist the influence of global agribusiness by reducing dependence on chemical inputs. Detractors call it a waste of time that is diverting resources from more promising approaches such as genetic engineering." The journal *Field Crops Research* (Vol. 88, Issue 1) took a critical look at SRI with the article *Fantastic yields in the system of rice intensification: Fact or fallacy?*, by J.E. Sheehy, S. Peng, A. Dobermann, P.L. Mitchell, A. Ferrer, Jianchang Yang, Yingbin Zou, Xuhua Zhong and Jianliang Huang, and the discussion *Agronomic UFOs*, by Thomas R. Sinclair and Kenneth G. Cassman. (See *Grain of Truth*, pages 42-43.)

- Also in *Field Crops Research* (Vol. 87, Issue 1) is

the short communication *Trends in Rice-Wheat Area in China*, by IRRI economist David Dawe and Steve Froking and Changsheng Li, both of the Institute for the Study of Earth, Oceans and Space at the University of New Hampshire. Combining two methods of estimating the area of farmland planted to rice and wheat in rotation in China yielded an estimate of 3.4 million ha, much less than figures found in the literature, which run as high as 13 million ha.

- The *Manila Times* reported on 5 February the launch by Philippine President Gloria Macapagal Arroyo of five hybrid varieties collectively known as **Gloria Rice**, quoting farmers who reported doubling their harvests to 10 t/ha. On 6 March, *Today* newspaper contrasted the government's forecast of yields 2 to 3 times higher than the current national average of 3 t/ha with the assertion of the farmers group Masipag that such high yields are possible only under the ideal conditions experienced by few farmers.

- The Xinhua News Agency reported in mid-April on a **hybrid rice** exhibition at Sanya, Hainan, and Chinese efforts to export hybrid rice technology globally. The report said that hybrid rice area in 2003 reached

1 million ha in South and Southeast Asia. Chinese hybrids were reportedly doing exceptionally well in Egypt, producing 35% more grain in saline-alkali soil than in normal soil. Another Xinhua report said that Hainan Province will establish five natural reserves for endangered **wild rice**, which it called the "giant panda of the botanical world."

- The April edition of *International Development Review*, the in-house publication of the British Department for International Development (DFID), and 1 March edition of *New Agriculturalist on-line* (www.new-agri.co.uk/04-2/focuson/focuson2.html) both reviewed DFID-funded research in India and Bangladesh by IRRI weed scientist David Johnson and his collaborators on controlling **weeds in direct-seeded rice**.

- Deryn Hinch hosted on 21 May an Independence Ball for **East Timor**, whose 500 invited guests were asked to bring a bag of rice with \$2 taped to it to cover shipping costs to the famine-threatened nation. The Australian talkback radio host decided to take things a step further, asking listeners to his program on Melbourne radio station 3AW to do the same. The campaign raised US\$40,000 and more than 10 tons of rice.

Science scrutinizes 'crown jewels' initiative

In the 27 February edition of *Science* (Vol. 303, No. 5662, pages 1281-1283), Dennis Normile reported on efforts to achieve closer cooperation, and perhaps a merger, between IRRI and the International Maize and Wheat Improvement Center (CIMMYT). The aim of "the crown jewels of the Consultative Group on International Agricultural Research (CGIAR)," he wrote, is "a heightened and more centralized effort to use genomics to enhance germplasm."

"We know now that the major cereals have a majority of their genes in common," IRRI Director General Ronald Cantrell was quoted as saying. Normile added that the two institutes' "taking advantage of the similarities among the cereals might lead to a shared genomics laboratory, jointly appointed researchers and possibly even a common board." Savings in lab costs could be augmented by efficiencies from centralized bioinformatics efforts, intellectual-property management and training programs.

Normile explained that the initiative arose in response to lower funding levels for both centers and a donor-led diversion of money from basic germplasm research into other areas. "A recent evaluation by the World Bank of some 700 previous reports and studies notes that CGIAR spending on improving crop productivity declined by 6.5% annually in real terms through the 1990s and that training programs for the developing world decreased by nearly 1% a year (see graphic)," he reported. "At the same time, research into environmental protection and biodiversity were receiving

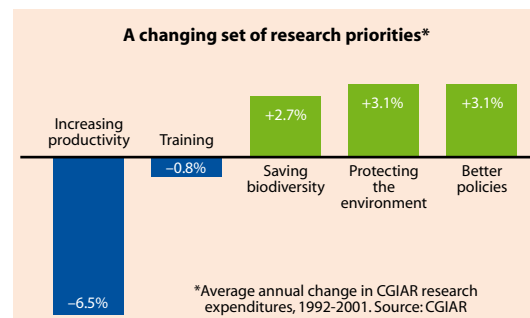
larger shares of a shrinking pie.

"The resulting fierce competition among centers for scarce funding isolated research programs at a time when germplasm research efforts could have benefited from greater collaboration, especially in biotechnology. While private companies and universities in advanced countries invested \$8 billion to \$10 billion in agricultural biotechnology in the 1990s, says Uma Lele, an agricultural economist who led the World Bank review, the CGIAR system spent just \$25 million. 'For a billion poor people in the world, that is just minuscule,' she says."

The combined weight of IRRI and CIMMYT within the CGIAR has led to speculation that the initiative — which is overseen by a committee chaired by Gordon Conway, president of the Rockefeller Foundation — could shake up the structure of the entire group.

"Perhaps the biggest question is how donors will react," wrote Normile. "Rockefeller's Conway, an agricultural ecologist, says that coupling a new functional genomics program to the existing germplasm banks and field-testing expertise of the two centers will create 'a really powerful basis for producing new crop traits' that might appeal to donors. So, too, might a report from the Rockefeller Foundation offering a blueprint for a new, improved CGIAR."

• The 19 April edition of the *Financial Express* described an IRRI-CIMMYT merger as the "height of folly." Editorialist



Ashok B. Sharma wrote: "One should not think that the roles of IRRI and CIMMYT are over with the ushering in of the Green Revolution. There are still millions of hungry people in Asia, Africa and Latin America. Both IRRI and CIMMYT still have effective roles to play.

"The national governments, in the interests of greater public welfare, should increase their funding to the CGIAR system in general and to IRRI and CIMMYT in particular. Also in the interest of greater public welfare, the CGIAR system should maintain its image as a global public-sector research body working for public good.

"The CGIAR should not depend upon funds from private sector."

• The *Manila Times* on 20 April reported that IRRI's budget had fallen from US\$44.49 million in 1993 to \$27.1 million (www.manilatimes.net/national/2004/apr/20/yehey/metro/20040420met6.html). Citing Dr. Cantrell, it said IRRI is developing a long-term strategy to tap Asian funding, beginning this year with members of the Association of Southeast Asian Nations.

Daily Star covers poverty mapping, technology uptake and women in farming in Bangladesh

The *Daily Star* newspaper examined a range of rice-related developments in Bangladesh in March and April.

On 4 March, it covered a workshop on poverty mapping held at the Local Government Engineering Department, which participated in this IRRI-led project along with the Bangladesh Agricultural Research Council and the Bangladesh Bureau of Statistics (see *Pinning down poverty* on page 30). "Rural poverty is of direct concern for policymakers, planners, and implementers of agricultural and rural development programs," Mirza Fakhrul Islam Alamgir, state minister for agriculture, was quoted as telling the workshop.

The article added: "Noting that the rural poverty is not spread evenly across the countryside, the state minister said there was a need for detailed information on hot spots of poverty so that the govern-

ment can target the development program more precisely."

The 18 April edition reported on a 2-day workshop on Uptake Methods and Pathways organized by the Department of Agricultural Extension and the IRRI-led project Poverty Elimination Through Rice Research Assistance. At the workshop, Agriculture Minister M.K. Anwar pointed out that agriculture receives only 2.47% of the country's annual development budget, down from 22% in 1979. He promised that the next budget will include measures favoring farmers to lower high rice production costs.

On the front page of its 23 April edition, the *Daily Star* covered a dialogue on "Women's contribution to rural economic activities: Making the invisible visible," organized by the Center for Policy Dialogue (CPD). Agriculture Minister Anwar, State Minister for Agriculture Alamgir, and Awami League

Agriculture Secretary Mohammad Abdur Razzaque were among those who addressed the gathering, which was chaired by Fazle Hasan Abed, member of the CPD Board of Trustees and chairman of the Bangladesh Rural Advancement Committee.

Representing IRRI were Social Sciences Division Head Mahabub Hossain and gender specialist Thelma Paris. Dr. Hossain recommended channeling agricultural credit through women and new government projects to train women in improved agricultural technologies and support their income-generating activities around the homestead.

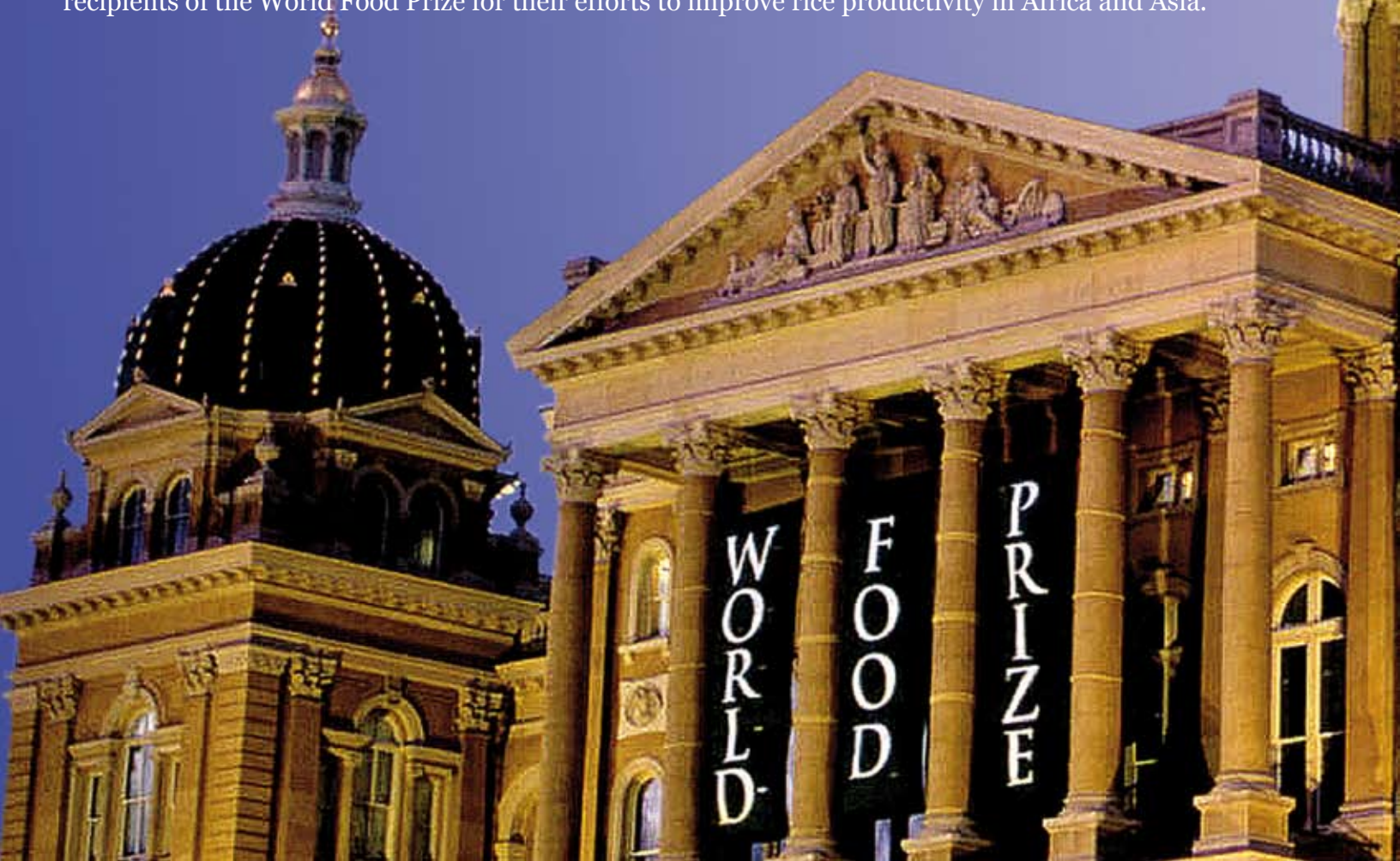
The article quoted Dr. Paris as adding, "Stereotyped notions that rural women are housewives should be discarded and replaced by the recognition that their roles in production and their contributions to family income are crucial for improving the livelihoods of the household."

WORLD FOOD reprise

*by Ambassador
Kenneth Quinn*

The Nobel-inspired World Food Prize puts rice back on the menu

Rice, the world's most widely consumed grain, plays a unique role in combating global hunger. Reflecting this, the World Food Prize has recognized seven scientists and world leaders for their exceptional achievements in rice — more than in any other area of food production. This trend was reinforced on 29 March at a ceremony at the United States Department of State hosted by Secretary of State Colin Powell. At this event, it was my pleasure and honor, as president of the World Food Prize Foundation, to name two more scientists, Monty Jones of Sierra Leone and Yuan Longping of China, as recipients of the World Food Prize for their efforts to improve rice productivity in Africa and Asia.





THE IOWA STATE Capitol Building in Des Moines decked out in celebration of the US\$250,000 World Food Prize.

The announcement coincides aptly with the United Nations' designation of 2004 as the International Year of Rice. The ceremony in Washington — attended by over 250 diplomats, experts and policymakers including U.S. Secretary of Agriculture Ann Veneman and Jacques Diouf, director general of the Food and Agriculture Organization of the United Nations — was notable in another respect. It served as a

surprise celebration of the 90th birthday of Norman Borlaug, with Sec. Powell leading the diplomatic corps in singing *Happy Birthday* to the World Food Prize founder (see *Iowa's international harvester* below).

Now in its 18th year, the World Food Prize honors individuals who have made significant contributions to improving the quality, quantity or availability of food throughout



THE AFRICA RICE CENTER (WARDA)

Iowa's international harvester

Born in a rural Norwegian-American community in northeastern Iowa on 25 March 1914, Norman Borlaug was — like hundreds of millions of beneficiaries of his life's work worldwide — raised on a family farm and first educated in a one-room schoolhouse.

In the 1940s, armed with degrees in forestry and plant pathology, he began working in a wheat-research program jointly sponsored by the Rockefeller Foundation and the Mexican government. His achievements in Mexico — notably the development of short-strawed wheat cultivars able to produce high yields and resist disease — were the beginning of a distinguished career in fighting world hunger. After helping to reverse severe food shortages in India and Pakistan in the 1960s, Dr. Borlaug continued his work in other hunger-ravaged nations throughout the world, never losing sight of his goal to provide food for the countless millions suffering the pangs of malnourishment.

As a result, Dr. Borlaug saved as many as a billion lives throughout the world. For this unprecedented service to humanity, the man now known as the father of the Green Revolution received the Nobel Peace Prize in 1970.

Yet, as he accepted the world's premier humanitarian honor, Dr. Borlaug realized that no provision existed for regular recognition of the work of others in the fight to end world hunger. There was no system to honor the achievements of thousands of scientists, farmers, political leaders and humanitarians working toward global food security in fields as diverse as agriculture, ecology, nutrition, economics, manufacturing and public policy. He envisioned a World Food Prize, knowing that establishing it would be a difficult task. However, overcoming immeasurable challenges was nothing new to Dr. Borlaug, so when the first World Food Prize was awarded in 1987, few were surprised by its success.

This year's laureate announcement in March at the Department of State in Washington, D.C., which did double duty as a 90th birthday celebration for Dr. Borlaug, gave Secretary of State Colin Powell the opportunity to express sentiments that many have long cherished.

"Thanks to Dr. Borlaug's pioneering work in the 1960s to develop varieties of high-yielding wheat, countless millions of men, women and children, who will never know his name, will never go to bed hungry," Sec. Powell observed. "Dr. Borlaug has been an inspiration to new generations across the globe who have taken up the fight against hunger."

On 10-12 July, the World Food Prize Foundation will join the Chinese Academy of Agricultural Sciences to celebrate Dr. Borlaug's birthday again in Beijing, where the father of the Green Revolution will be guest of honor — along with Yuan Longping, China's homegrown 2004 World Food Prize laureate — at the International Symposium on Science and Technology in Agriculture: Current and Future. In October, as people everywhere mark World Food Day, the foundation will bring the celebration back home to Des Moines, Iowa (see *Ear of rice* on page 17).



CHIMMYT

NORMAN BORLAUG'S contributions to world agriculture have saved a billion lives.

the world. The mission of the World Food Prize Foundation, which awards the annual US\$250,000 prize, is threefold: to recognize exceptional achievement across the entire food production and distribution process, to highlight how scientific innovation might solve problems affecting the process, and to inspire others to dedicate their careers to helping to feed the world and eradicate hunger.

Yuan Longping, while at the Hunan Academy of Agricultural Sciences in China, achieved a major scientific breakthrough as he developed the genetic materials essential for breeding high-yielding hybrid rice varieties. Now widely considered the father of hybrid rice, Prof. Yuan is being recognized for developing hybrids that yield up to 20% more grain than inbred varieties.



EMILY WESTERGAARD, THE WORLD FOOD PRIZE

AT THE 29 MARCH laureate announcement at the Department of State in Washington, D.C., are (from left) Ambassador Kenneth Quinn, president of the World Food Prize Foundation and author of this feature; John Ruan III, vice-chairman of the World Food Prize Foundation; Alan P. Larson, under secretary of state for economic, business and agricultural affairs; Ann Veneman, secretary of agriculture; Colin Powell, secretary of state; Jacques Diouf, director general of the Food and Agriculture Organization of the United Nations; Norman Borlaug; Andrew Natsios, administrator of the U.S. Agency for International Development.



WORLD FOOD PRIZE laureates (from left) Monty Jones (2004), Yuan Longping (2004), M.S. Swaminathan (1987, pictured with Philippine President Corazon Aquino at IRRI in 1986), Robert F. Chandler (1988, with Philippine President Diosdado Macapagal and John D. Rockefeller III at the formal dedication of IRRI in 1962), Henry Beachell (1996, with Dr. Chandler and the Philippine and American first ladies Imelda Marcos and Lady Bird Johnson at IRRI in 1966) and Dr. Swaminathan again (with Lu Liangshu, president of the Chinese Academy of Agricultural Sciences, in 1985).

Further, Prof. Yuan has made a concerted effort to educate others about his discovery, thus spreading the benefits to more than 10 other countries worldwide. His work has directly contributed to the production of enough additional food to sustain 60 million people.

Breakthrough achievement

Born in Sierra Leone, Monty Jones became in 1991 the head of the Upland Rice Breeding Program of the West Africa Rice Development Association (WARDA) – The Africa Rice Center, one of 15 international

research centers funded through the Consultative Group on International Agricultural Research by the World Bank and other member donors. It was in this position that he made his breakthrough achievement of combining Asian and African rice varieties to develop a new rice uniquely suited to the upland conditions farmed by poor Africans. These varieties, which came to be known as New Rice for Africa, or NERICA, provide African farmers with much-needed alternatives to existing rice varieties. As the father of NERICA, Dr. Jones is credited with increasing many African farmers' upland rice yields by half or more.

In October, Prof. Yuan and Dr. Jones will travel to Des Moines, Iowa, to receive their award and participate in the 2004 World Food Prize International Symposium, From Asia to Africa: Rice, Biofortification and Human Nutrition. Along with the laureate announcement in Washington, D.C., the Laureate Award Ceremony and Symposium will likely be remembered as a defining event of the International Year of Rice (see *Ear of rice* on page 15).

Scientific and policy achievements related to rice — the primary food of 17 countries and billions of individuals throughout the world — have greatly advanced the struggle to feed some of the world's largest and most undernourished populations. Prof. Yuan and Dr. Jones



are the most recent World Food Prize laureates honored for their work on this essential grain, adding a new chapter to the prize's rich history of recognizing achievements in rice production.

This history started with the inaugural World Food Prize. In 1987, M.S. Swaminathan became the first World Food Prize laureate for his work in extending the Green Revolution to India, which led to a doubling of that country's total wheat and rice output in just 5 cropping seasons. Dr. Swaminathan promoted high-yielding rice varieties





JESUS VICTOLERO

developed by the International Rice Research Institute (IRRI) to Indian farmers through test plots and demonstrations, thus advancing a revolutionary approach to agricultural extension in India that reversed yield stagnation and helped feed millions.

The prize recognized progress in rice again the following year, as IRRI's founding director general, Robert F. Chandler, became the 1988 laureate. Dr. Chandler was selected for his role in preventing widespread famine in Asia, as IRRI, under his leadership, helped raise the continent's rice harvest by two-thirds. The prize also recognized Dr. Chandler's continued contributions after he moved on from IRRI to become the founding director of the Asian Vegetable Research and Development Center, where he was instrumental in improving the diets of millions of undernourished people throughout the world.

Eight years later, in 1996, the World Food Prize honored Henry Beachell and Gurdev Khush, who worked together at IRRI to develop new strains of rice with dramatically improved yields. Dr. Beachell applied to rice Norman Borlaug's principle of breeding sturdy, short-strawed cultivars. The results were semidwarf rice cultivars that yielded nearly twice as much grain as traditional varieties. Dr. Khush, a student of Dr. Beachell's at IRRI, carried on his mentor's work by breeding into these high-yielding modern varieties improved resistance to diseases and pests. The innovations developed by these two men led to a high-yielding and resilient rice variety that at one point occupied over 70% of the world's rice lands.

I witnessed, 3 decades ago while working in the Mekong Delta, the dramatic impact of the rice varieties developed by Drs. Beachell and



AILEEN DEL ROSARIO-RONDILLA



BOB ELBERT, THE WORLD FOOD PRIZE

RAY CHARLES and the Des Moines Symphony Orchestra keep the music flowing at the 2002 Laureate Ceremony in Iowa. At the IRRI Experiment Station in the Philippines (*top, from left*), Gurdev Khush, 1996 World Food Prize laureate, examines a rice field in 1999 with Norman Borlaug and Sant Virmani, IRRI principal scientist in plant breeding and pioneer of tropical hybrid rice, and (*bottom*) Arnold Manza, Experiment Station senior manager, demonstrates the institute's modern rice mill to Yuan Longping in 2003.

Khush. The arrival of the new seeds from IRRI coincided with the building of new roads — rice and roads together clearly driving dramatic improvement in the quality of life. But, where the road-building stopped, so did the spread of technology.

Rice scientists are not the only World Food Prize laureates who have helped make the global rice harvest both more bountiful and more economically and environmentally sustainable. The prize has gone to several individuals whose substantial contributions to agriculture as a whole — in the realms of government and business as well as science — benefited



Ear of rice

With the October 2004 World Food Prize Harvest Festival in Des Moines, Iowa, the Corn and Soybean State will become the venue for arguably the world's most focused observance of the International Year of Rice. Highlights among the more than 200 events statewide will be celebrations of Norman Borlaug's 90th birthday and the formal presentation of the World Food Prize to the 2004 laureates, Monty Jones of Sierra Leone and Yuan Longping of China.

Reflecting the origins of the new laureates, the World Food Prize Foundation has applied the theme "From Asia to Africa" to its 13-14 October Symposium on Rice, Biofortification and Enhanced Nutrition.

The distinguished speakers at the symposium will be (in alphabetical order) **Catherine Bertini**, United Nations under secretary general, chair of the UN Nutrition Council and 2003 World Food Prize laureate; **Howarth Bouis**, director of the HarvestPlus biofortification challenge program of the Consultative Group on International Agricultural Research (CGIAR); **Joachim von**

Braun, director general of the International Food Policy Research Institute of the CGIAR; **Ronald P. Cantrell**, director general of the International Rice Research Institute of the CGIAR; **Gordon Conway**, president of the Rockefeller Foundation; **Susan McCouch**, professor of plant breeding in the Rockefeller Rice Biotechnology Program at Cornell University; **Pedro A. Sanchez**, professor of tropical agriculture at Columbia University, 2003 MacArthur fellow and 2002 World Food Prize laureate; **Alfred Sommer**, dean of the Bloomberg School of Public Health at Johns Hopkins University; **M.S. Swaminathan**, chairman of the M.S. Swaminathan Research Foundation, co-chair of the UN Millennium Project's Hunger Task Force and 1987 World Food Prize laureate; and **Steven Tanksley**, chair of the Genomics Initiative Task Force at Cornell University and 2004 Wolf Prize recipient.

For more information on the 2004 International Symposium or to register, please visit www.worldfoodprize.org.

rice along with other crops and so enhanced global food security.

Disseminated knowledge

Former Chinese Minister of Agriculture He Kang, the 1993 World Food Prize laureate, was recognized for setting policies that allowed China to become one of the most efficient rice-producing countries in the world. Minister He helped rebuild a national infrastructure that had been devastated by years of neglect, notably restoring resources to Chinese agricultural universities, which brought a vast increase in the use of new rice-farming methods. In addition, Minister He's efforts helped

disseminate knowledge of new high-yielding rice varieties to his nation's farmers.

In 1997, Ray Smith and Perry Adkisson were awarded the World Food Prize for addressing sustainable pest control, one of the greatest challenges facing agriculture, not least rice production. Drs. Smith and Adkisson together developed what is perhaps the most environmentally friendly and cost-effective approach to pest control. The system, known as integrated pest management, stresses limiting the use of polluting agricultural chemicals by employing instead natural pest-control methods.

Each of these accomplished individuals, through his unique and innovative approach, has dedicated his life to ensuring that the world is adequately fed. It is to recognize such selfless dedication that the World Food Prize exists. For their work on rice, Prof. Yuan and Dr. Jones join an illustrious procession of men and women thus honored. 🍚

Dr. Quinn, former U.S. ambassador to Cambodia, is president of the World Food Prize Foundation (www.worldfoodprize.org). Emily Westergaard and Nicholas Young contributed to this article. For more about the International Year of Rice, see www.rice2004.org.



Rice revealed — with more in store

by Adam Barclay
photography by Al Benavente

After a decade of celebrating rice and instilling knowledge of the essential grain, the Riceworld Museum and Learning Center marks the International Year of Rice with a timely celebration of... itself

When 39 members of the Manila diplomatic community journeyed 60 km southeast of the Philippine capital for an International Year of Rice open day at the International Rice Research Institute (IRRI), they got more than the usual VIP tour. After inspecting the International Rice Genebank and the institute's state-of-the-art rice mill and experimental fields and laboratories, the guests returned to their starting point, the Riceworld Museum and Learning Center. After a brief ceremony marking Riceworld's 10th anniversary and a ribbon cutting, they indulged in an activity never before offered to visitors at IRRI. They went shopping.

Since that grand opening on 4 March of the Riceworld Bookstore and Coffee Shop, all visitors to IRRI's headquarters in Los Baños, Laguna, have the option of sipping



their favorite coffee as they browse for T-shirts, hats, publications and trinkets. It's not a bad way to round out a couple hours of garnering knowledge about the grain that feeds half the world.

Riceworld actually opened in September 1994, but marking the 10th anniversary in March made sense beyond aligning the celebration with the open day for diplomats. In March 1994, another high-powered visit to IRRI — by Gunther Beck, head of the Southeast Asia and Pacific Department of the German government funding agency BMZ — set the languishing dream of Riceworld on the road to reality.

Klaus Lampe, IRRI director general in 1988-95 and a German national himself, mentioned to Beck that IRRI was considering plans for some sort of rice education center. The idea was to develop a space that



FRANKLIN SILVA (*bottom left*), chancellor of the Portuguese Embassy in Manila, browses in the new Riceworld Bookstore and Coffee Shop. The exhibits in the museum and learning center itself include traditional harvesting knives and sickles from across Asia; (*continuing clockwise*) unthreshed bundles of glutinous rice from Banaue, Philippines; rice-straw sandals from Nepal; a Philippine *yatab* harvesting knife; samples of wild, traditional and modern rice varieties; and a Thai ox cart used to transport harvested rice, farm implements and people. The wooden *bulul* figure opposite is a granary guardian of the Ifugao minority in the mountains of northern Luzon in the Philippines.



could act as a focus for visitors — be they foreign dignitaries or Filipino schoolchildren — that would inform them of IRRI's research and the role rice plays in ensuring global food security and underpinning Asian cultural identity, economic development and environmental protection. The facility would also allow scientists to spend less time with visitors and more time doing research.

Beck asked to see the funding proposal, unaware that a formal document did not yet exist. Three frenetic hours

later, a proposal was in his hands. GTZ promptly donated US\$73,000, and just 6 months later, on 22 September 1994, the German ambassador, H.E. Karl-Friedrich Gansauer, officially opened Riceworld.

Mar Movillon, who managed the center in 1995-2002, recalls Riceworld's long gestation until GTZ came along.

"The idea originally came from M.S. Swaminathan in the 1980s," he reports, naming the 1987 World Food Prize laureate who

served as IRRI director general in 1982-88 (see *World food reprise* on page 12). Dr. Swaminathan pointed out that busloads of schoolchildren arrived at IRRI every day to find almost nothing specifically designed to foster in them an appreciation of the history and value of rice. He wrote at the time of the need that "young students who come in large numbers to IRRI have an opportunity to learn about the antiquity and fascinating history of the rice plant."

"By that time, IRRI had accumulated a number of artifacts that were kept in a room at the Training Center," Movillon explains. Many of the original artifacts, if not most of them, were donated by Harold Conklin, former curator of anthropology at Yale University's Peabody Museum of Natural History in the United States. According to Duncan Macintosh, head of IRRI's Visitors and Information Services, Riceworld would not be what it is today without him.

Unsung hero

"He's an unsung hero of Riceworld," says Macintosh. "Prof. Conklin had been coming to the Philippines since the 1940s. He first came to study the Ifugao and the rice terraces of northern Luzon. His most recent trip was 2 years ago, when he was in his 70s. On every trip he's made, he couldn't help but collect artifacts. He didn't want to take them back to the States, so he left them here at IRRI."

If Prof. Conklin kick-started Riceworld with his collection, it was a wide and diverse group

RICEWORLD SHOWCASES rice festivals and customs, displaying brilliantly colored *kiping*, the leaf-shaped rice-paste wafers that are used to decorate houses during the Pahiyas festival, held on 15 May in honor of San Isidro Labrador, the patron saint of farmers, in Lucban and surrounding towns in the Philippines. Male and female *bulul* granary guardians (*right*) from the Philippines.





RICEWORLD SUPERVISOR Paul Hilario (fifth from left) guides a group of visitors to the museum and learning center; Riceworld displays (top) on rice rituals, customs and festivals.

that grabbed hold of the wheel. “Once things got moving, people volunteered to help us,” reports Ben Vergara, IRRI director of administration in 1991-96 and probably the person most responsible for driving Riceworld’s initial development. “We used to work until 11 at night. Some of the carpenters and other workers worked with no overtime pay, because it was fun.”

A call went out to people far and wide who might donate exhibits or offer advice, attracting especially useful suggestions from Yoshiko Yamamoto, a museum expert at San Francisco State University. “We wrote to IRRI people in other countries — Thailand, Cambodia, Laos, Indonesia,” Movillon recalls. “They started sending farmers’ clothing. Embassy officials organized donations from their countries.”

The Momi of all rice seeds

The most striking — and contentious — exhibit in the Riceworld Museum and Learning Center is Momi, the giant sculpture of a sprouting wild rice seed by renowned Japanese artist Mitsuaki Tanabe. Momi, Japanese for unhulled rice, communicates the vitality of wild rice at germination by depicting the seed protruding from the ground and sprouting both shoot and root. At 6 meters long and 4 meters tall, the brightly colored, wooden structure is impossible to miss and, according to IRRI Visitors and Information Services Head Duncan Macintosh, elicits a wide range of responses from visitors.

“Some people come in and say, ‘What is that thing? What a waste of money!’ But the issue that all visitors to Riceworld have in their mind when they leave is wild rice,” he observes. “Why? Because the one thing everybody remembers is this huge abstract sculpture. It’s a very smart strategy. Mr. Tanabe wanted people to talk about wild rice, and he’s been wildly successful. No one can walk past Momi without asking what it is. So his intent actually works extremely well, even if a lot of people think it doesn’t. It took me a year to understand that.”

Tanabe approached IRRI with his Momi idea in the early 1990s and constructed it over several months in 1994. The project was jointly funded by IRRI and the newly formed Wild Rice Club of Japan, a group of businessmen who, having grown weary of sponsoring golf tournaments, decided to focus on something more socially worthwhile and responded to Tanabe’s idea of promoting wild rice conservation. This year, the club is organizing the World Wild Rice Forum 2004 and Asian Wild Rice Music Festival in Osaka on 8 August (see ad on page 39).

After completing IRRI’s Momi, Tanabe created a 33-meter-long, 4.5-ton stainless-steel rice grain for the Pathum Thani Rice Research Institute in Thailand, which occupies a rice field 70 km northeast of Bangkok. His most recent effort is an 11-meter-long stainless-steel rice sculpture donated to India’s Central Rice Research Institute in 2002.

Tanabe plans to start work this year on another giant rice sculpture in the far north of Australia. With help from the local Aboriginal community — who knew about Australian varieties of wild rice long before anyone else — he will carve the structure into a natural granite formation.



MITSUAKI TANABE supervises the installation in 1994 of his 4-meter-tall Momi sculpture, which dwarfs Visitors Officer Frances Tesoro (below).



Vintage farming equipment found lying around IRRI was spruced up. Former IRRI scientist S.W. Ahn donated his family's *dui-joo*, a traditional Korean wooden rice container. Visitors from the Mangyan ethnic minority on the nearby Philippine island of Mindoro were excited to see exhibits of traditional rice-farming implements and donated some of their own in the knowledge that Riceworld would preserve them for future generations.

The new facility made IRRI a magnet for visitors, especially Filipino school groups. The number

of visitors ballooned from 34,000 in 1994 to more than 120,000 in 1997. The following year, more careful spacing of school groups pushed the number of visitors down to a more manageable 71,000. In all, 650,000 people have visited IRRI since the learning center opened.

Riceworld offers a crash course in the breadth and depth of rice's place in the world — particularly in Asia, but also on every other continent except Antarctica. The sheer diversity of cultural exhibits rams home the integral role that rice plays in cultures worldwide.

A SAMPLING of the surprising variety of food and drink made from rice. The *dui-joo* (top) recalls traditional grain storage in Korea, and the Philippine buffalo cart (bottom) is one of several antique carts on display.



As you stroll through Riceworld, you learn the story of the essential grain. The first exhibits link the ever-increasing global population with the need to grow more rice — and so the need for rice research to help farmers produce ample supplies of affordable rice with minimal impact on the environment. These are followed by displays on rice-growing environments and examples of traditional and modern rice-farming implements and technologies. One area showcases insects — both rice pests and the farmers' friends that prey on them. Another informs about different lineages of rice and the need to conserve all rice varieties — wild and cultivated, traditional and modern.

Rice products

Exhibits showcase rice products — food, drink, footwear, hats, ornaments and art — as well as the role of women in rice and the influence of rice on traditional cultures. A video from inside a traditional stilted hut of the northern Philippines' Ifugao community shows priests, or *mumbaki*, performing rice-growing rituals.

Macintosh emphasizes that Riceworld is not just a museum concentrating on the past but also a forward-looking learning center.

"The very use of the word 'museum' points out a fairly fundamental problem," he says. "Museums are what people know. They're what attract funding. But we as a scientific institute develop technologies for the future, so why should we look back? Considering



the number of students that visit us — more than 72,000 out of last year's total of almost 87,000 visitors — it really is an educational center."

"To better engage the students, IRRI has just developed workbooks graded by age group," adds Riceworld Supervisor Paul Hilario. "These help schoolchildren learn as they tour the center."

Hilario stresses that other visitors — including diplomats, scientists, farmers, politicians and tourists — must not be forgotten. "Riceworld needs to play more to its diverse audience and give them a richer learning experience," he says. "Visitors would like more interactive exhibits, and we don't yet have enough of these. We plan to turn Riceworld into a place that caters to all age groups. Most of the displays will be student-centered, but for other visitors wishing to investigate more deeply, we'll provide information-on-demand exhibits."

The search for funding to keep Riceworld displays fresh and engaging will no doubt suffer setbacks — which the center has already learned to endure. Macintosh vividly remembers the evening of Thursday, 2 September 1999. He had arrived 4 months earlier as IRRI spokesperson and was still working out with management how reorganization would put Riceworld under his care.

"We had just finished work," he recalls. "It was about 6 pm. I walked out of another building and smelled smoke — then saw smoke rising from the back of Riceworld, near the



RICEWORLD VISITORS learn about rice pests and the farmers' friends that prey on them, including (clockwise from top left) the adult moth of the rice greenhorn caterpillar, the grasshopper, the adult and pupa of the rice skipper, the rice bug, the ladybird beetle (which preys on such pests as mealybugs, hoppers and aphids) and the yellow stem borer.

library. Just then, fire engines started to arrive. The fire went on for 4 or 5 hours after that, well into the night. There was heavy smoke all through Riceworld, and you couldn't enter without breathing equipment."

The fire, caused by rat damage to wiring, spread throughout the ceiling. Firefighters smashed through the roof to extinguish it, but smoke and water caused considerable damage, requiring Riceworld's closure for several months. Movillon and Riceworld Assistant Harris Tumawis all but lived there while they rushed to repair exhibits and clean the building in time for IRRI's 40th anniversary celebration in 2000.

Audiovisual facility

Completely gutted was Chandler Hall, a 192-seat auditorium at the heart of Riceworld that wouldn't reopen until April 2001. Today, the refurbished and upgraded audiovisual facility is one of the best in the region.

Hilario has taken the lead in recovering some of Riceworld's maintenance costs by opening Chandler Hall for corporate and community meetings and activities. He has also taken charge of upgrading

exhibits and implementing new ones. One plan is to dedicate a new room to rotating exhibitions covering such hot rice issues as genetic modification and the environmental impact of rice farming.

Agriculture isn't usually counted among modern, knowledge-based industries. However, research by IRRI and its national partners amply demonstrates how knowledge is as essential as good seed and sturdy tools to farmers striving to improve their livelihoods by growing rice more efficiently and sustainably. Similarly, popular support for sound agricultural and food policies depends on widespread knowledge and understanding of the issues involved.

As Riceworld enters its second decade, the museum and learning center renews its commitment to satisfying this hunger for knowledge. 🍌

Riceworld Museum and Learning Center is open to the public 8 am-5 pm, Monday-Friday, excluding public holidays. Admission is free. Large groups should make prior arrangements with Bita Avendaño, tel (+63-2) 580-5600, fax (+63-2) 580-5699, email b.avendano@cgiar.org. Riceworld Bookstore and Coffee Shop offers rice-related books and souvenirs, as well as snacks, coffee and cakes.







The whole way

by Adam Barclay

Going the distance with a holistic *Environmental Agenda* that captures decades of experience in environmental protection

The environment will always feel the impact of agriculture, not least of rice farming. Rice is the staple food of almost 3 billion people, and rice farms cover almost 150 million ha — more than any other crop. Much of this land is flooded paddies, whose unique environmental implications include land leveling and terracing, heavy water demand, and greenhouse gas emissions. In addition, the rice landscape is in many areas extremely rich in biodiversity, the survival of which depends on careful management.

Responding to an initiative by a respected Brazilian member of its Board of Trustees, Dr. Emanuel A.S. Serrão, the International Rice Research Institute (IRRI) recently acted to ensure that environmental sustainability will always be central to its research program, as well as to its day-to-day operations at its research campus and its relationship with neighboring communities. IRRI management decided the time was ripe to codify the institute's longstanding commitment to environmental protection and sustainable rice production. Formal implementation of the resulting *Environmental Agenda* will take place over the coming year.

The initiative arose partly in response to the 1992 Rio Earth Summit and the 2002 World Summit on Sustainable Development in

Johannesburg. These events firmly established a global commitment to protect and conserve the environment while achieving social and economic development — all of which influence, and are influenced by, agriculture in general and rice farming in particular. Compounding this commitment, the United Nations Millennium Development Goals set a target of halving 1990 levels of world poverty by 2015, while ensuring environmental sustainability and reversing the loss of natural resources.

“Environmental concerns have long been apparent in IRRI's research,” says Ren Wang, IRRI deputy director general for research and a core contributor to the *Environmental Agenda*. “But to take the environmental approach in a more holistic way, to consciously commit to conserving the environment and achieving sustainable development, and to package it in this way — I think that is something new.”

The *Environmental Agenda* identifies seven key environmental

CENTRAL TO MAKING farming more environmentally friendly, and so preserving and restoring such magnificent landscapes as this one in Bhutan, is the application of integrated pest management. This includes adopting farm practices that encourage the natural enemies of insect pests, such as spiders (*right*), and so eliminating the market for toxic and often misapplied pesticides (*overleaf*).

GENE HETTEL



IRRI

initiatives: poverty and human health; land use and degradation; water; biodiversity; farm chemicals and residues; climate change; and biosafety and genetically modified rice. Dr. Wang points out that the agenda recognizes that environmental concerns act both ways; while IRRI strives to reduce the impact of rice farming on the environment, the changing environment also affects rice farming.

"Global warming and other environmental trends are already having an impact on rice production, and this impact will increase," he explains. "Rice producers all over the world need to understand the implications of environmental change. For IRRI to help the national agricultural research and extension systems of rice-producing countries, we need to continue to develop technologies that can be used to cope with this change."

IRRI's commitment to environmental protection begins at home on its research campus at Los Baños in the Philippines. The institute's recycling scheme produces 10 tons of usable compost per year from lawn clippings and other biodegradable waste, and reduces waste volume by as much as 70%. As well as reducing energy use, the scheme minimizes dumping, burning and burying.

The *Environmental Agenda* reinforces IRRI's community spirit by promoting environment-friendly initiatives implemented for and with the institute's closest neighbors. Since 2000, IRRI Community Projects have contributed to the environmentally sustainable economic and social development of poor communities in

the municipalities of Los Baños and Bay. Dr. Wang points out that this is an example of an existing program at IRRI that benefits from inclusion in a formal agenda.

"You have to live in harmony with your surrounding society," he says. "IRRI wants to emphasize this harmony with respect to people and their environment. Building initiatives like Community Projects into the *Environmental Agenda* can increase local environmental consciousness and commitment. By doing things ourselves in an environmentally friendly way, we can help and encourage our neighbors to do the same."

IRRI's research program promises to extend the benefits of the *Environmental Agenda* to the farthest corners of Asia and beyond. These benefits include stemming farm-chemical pollution by promoting technologies that reduce and optimize their application, and conserving freshwater resources with water-saving rice varieties and farm practices. More broadly, IRRI's work to improve the health and livelihood of poor rice farmers and consumers directly addresses the rural poverty that is the most intractable threat to the environment.

Using crop biodiversity

Research by IRRI Principal Scientist Tom Mew into using crop biodiversity to control rice disease has enjoyed stunning success in China and is now being adopted in other countries. Dr. Mew investigated how to control the devastating fungal disease rice blast by interplanting two types of rice, a blast-resistant hybrid and a high-value but disease-susceptible traditional variety. The rows of hybrids limit the transmission of the fungus between rows of traditional plants, which nevertheless serve as refuges for the fungus, relieving pressure on it to overcome the hybrid variety's resistance. The technique preserves in place traditional varieties, extends the useful life of modern hybrids, and allows rice farmers to dramatically improve their income while reducing fungicide use.

Also helping both the environment and farmers' income is IRRI entomologist K.L. Heong's work to educate Vietnamese rice farmers about reducing their pesticide use. Injudiciously applied pesticides endanger farmers, the environment and — by killing rice-pest predators more effectively than the pests themselves — even the crops they are intended to protect. The No Early Insecticide Spray mass-communication initiative led by Dr. Heong uses posters, leaflets, and TV and radio dramas to inform farmers of the benefits of delaying and reducing pesticide applications — as does the follow-on Three Reductions initiative through which Dr. Heong and his collaborators additionally encourage farmers to use fertilizer and seed at lower, optimal rates. The two initiatives have seen the average number of insecticide applications in the project area fall from more than 3 sprays per crop to less than 1, earning them three major environmental awards.

Also aiming to reduce chemical inputs are IRRI's refinement and promotion of integrated pest management, which exploits crops' natural defenses. Modern biotechnology has the potential to offer rice farmers cultivars with greatly augmented pest and disease resistance. Meanwhile, IRRI has been a leader in developing site-specific nutrient management, by which farmers learn to apply fertilizer only when and as needed, thereby avoiding overfertilization and so reducing associated input costs, runoff pollution and crop disease.

Rice is grown across a broad range of environments. Among these, the most threatened are the rainfed or sloping upland environments, where farming can exert extreme environmental pressure in the form of soil erosion, deforestation and loss of biodiversity. Even in more favorable rice-growing areas, land degradation occurs if excessive irrigation increases soil salinity or depletes groundwater resources.

IRRI's development over the past 40 years of high-yielding rice varieties has helped double average rice yields from the pre-Green Revolution level



of less than 2 t/ha. Without this intensification, current rice production would need twice as much land as is currently sown to rice. IRRI aims to continue to raise rice productivity in favorable environments, so reducing the pressure to farm marginal lands. At the same time, the institute seeks to ensure that farmers who need to grow rice in fragile environments do so using environment-friendly technologies.

Water scarcity

Agriculture accounts for about 70% of the water drawn from freshwater sources worldwide. In Asia, this figure is 90%, and more than half of that is used to irrigate rice. Recent years have seen widespread deterioration of water quality and stiffening competition for often-depleted water resources from domestic and industrial users. The resulting higher water costs make irrigated rice less economically sustainable.

By 2025, more than 30 million ha of Asian irrigated rice lands will suffer physical or economic water scarcity. IRRI's modern rice varieties possess up to 3 times the water productivity of traditional varieties, and the institute's integrated approach seeks to develop rice plants and production practices that use water even more efficiently.

Reducing poverty is key to environmental sustainability because simple survival requires large numbers of poor people to exploit the natural environment, sustainably or otherwise. IRRI's research to improve rice productivity — and so raise incomes for farmers and farm laborers and lower prices for all rice consumers — can help, especially in Asia, where 800 million people live in poverty. IRRI has had a hand in developing about 1,000 modern rice varieties — or half the varieties released over the past 40 years in Asia's 12 main rice-growing countries.

By boosting production, these modern varieties have helped to slash world rice prices by 80% in the last 20 years, leaving poor rice consumers with more money to spend on the health care and education they need to climb out of poverty.

Billions of people from poor countries depend on rice for most of their nourishment. Today, IRRI's efforts to develop more nutritious rice, through both conventional breeding and biotechnology, promise further public health improvement by combating hidden hunger for the essential micronutrients iron, zinc and vitamin A.

The bottom line is that farmers across the rice-producing world need to grow more rice more efficiently. Smart research, carefully managed according to the environmental principles now enshrined in IRRI's *Environmental Agenda*, will help the world's rice harvest grow in an environmentally sustainable way. 🌾



Rice — Every grain tells a story

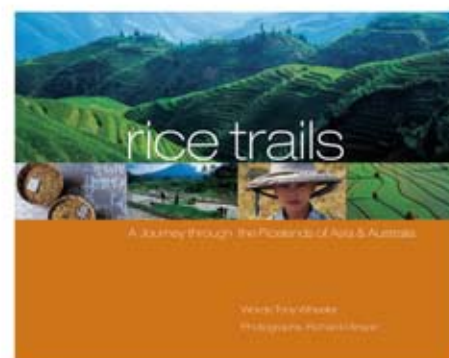
Rice is the world's most important food (in calories consumed it's number one) but also the most beautiful. Whether it's dropping down a hillside in the Philippines, China or Indonesia, each step is a little masterpiece of artistic perfection, or sweeping across laser-leveled 'bays' in pancake-flat Australia, it's always stunning.

In *Rice Trails* inveterate traveller Tony Wheeler, with his travel companion, renowned photographer Richard I'Anson, by his side, tells the story of rice from the paddy field to the table.

Rice is the world's most important food. But for billions of people, a grain of rice is much more than a source of nourishment. In *Rice Trails*, Wheeler and I'Anson show readers that rice, with its age-old festivals, traditions, ceremonies is at the cultural and economic heart of many communities.

With stunning photographs, *Rice Trails* takes readers on a fascinating and wonderful journey.

Rice Trails is a timely release as the UN Food & Agriculture Organization has declared 2004 the International Year of Rice.



Rice Trails: A Journey Through the Ricelands of Asia & Australia, with text by Tony Wheeler and photography by Richard I'Anson, is available now at all good bookstores and online at <http://shop.lonelyplanet.com>

Hardback, ISBN 1741043093, 160 pp, 200 photographs from Australia, Bangladesh, Burma, Cambodia, India, Indonesia, Japan, Nepal, Philippines, Singapore, Thailand, Vietnam

— authors: Tony Wheeler (left) and Richard I'Anson (right)





AILEEN DEL ROSARIO-RONDILLA (2)

On your mark, get set, **SELECT!**

by David Mackill



Reycel Maghirang (left) prepares DNA for marker testing at IRRI, as her colleague Alvaro Pamplona crosses rice plants.

Molecular markers give breeders the edge in the race against crop loss

A research highlight of 2003 was the sequencing of the entire rice genome. This achievement crowned 15 years of intensive mapping that began with a draft molecular map of the 12 rice chromosomes published in 1988 by scientists at Cornell University. Over the years, each improved draft has added to our catalog of molecular markers. A marker is a segment of DNA that is both easy to detect in a photographic gel image and located close to an allele (version of a gene) that controls an important trait in rice — close enough that the allele and the marker are effectively inseparable. Tracking the inheritance of markers thus allows breeders to track key alleles more accurately and quickly than they can by deducing inheritance the traditional way — by growing the plants to maturity and observing their traits.

Breeders transfer a target allele from one variety to another by a process called backcrossing. First, they cross the allele-bearing variety (the donor) with a popular cultivar (the recurrent parent) that has many desirable features but lacks this allele. They then select a first-generation hybrid that displays the target trait (and so apparently inherited the target allele) and cross it with the recurrent parent. They repeat this

backcrossing of offspring with the recurrent parent, gradually restoring in the progeny the characteristics of the recurrent parent.

One problem with this process is that it is time-consuming and laborious, usually taking 4 years or longer to produce a plant that has the desired donor allele but otherwise looks just like the recurrent parent. The other problem is that the augmented variety may *look* just like the recurrent parent, but it inevitably retains stray chromosome segments from the donor, especially surrounding the target gene. To a greater or lesser extent, it will fail to perform exactly like the recurrent parent, thus limiting its appeal to farmers.

Marker-assisted breeding tackles both problems. As illustrated in the figure (opposite), breeders can use three markers to select for a favorable allele. One, as mentioned above, is located so close to the allele that they are always inherited together. Two flanking markers are located on the chromosome a little to either side of the allele. When one flanking marker goes missing in an offspring, breeders know that the donor DNA is clipped tightly to the desired gene on that side. They backcross that offspring and find among the progeny plants that lack both flanking markers, indicating that the allele has

transferred cleanly, with little stray donor DNA tagging along. Inbreeding then creates plants with the same allele on the paired chromosome, ensuring trait stability.

Meanwhile, breeders scan gels of all the chromosomes for other markers associated with the donor, rejecting plants that have them. This is painstaking work, requiring a month in the lab for each generation, but the process is much faster than raising several generations to maturity. The result, in about 2 years, is an improved cultivar exactly like the recurrent parent except that it possesses the transferred advantageous gene.

Durable disease resistance

Over the past decade, scientists have pinned down the chromosome locations of hundreds of advantageous genes, many of which confer resistance to rice diseases and pests. Against some diseases, notably bacterial blight, breeders have used marker-assisted selection to “pyramid” into rice cultivars resistance conferred by several separate genes. Pyramided genes — which pile up various modes of resistance effective against different strains of the pathogen — promise broader and more durable resistance than a single gene.

Breeders have enjoyed success in transferring genes that alone offer black-or-white, or qualitative, resistance to a particular disease or pest, thereby reducing farmers' need to spray their crops. However, most of the traits that breeders are striving to improve today — including grain yield and tolerance of such complex abiotic stresses as problem soils, submergence and drought — are quantitative. This means they depend on more than one gene, with each individual gene controlling a relatively small effect.

Molecular marker technology has enabled scientists to identify and map on rice chromosomes the locations of hundreds of these genes, called quantitative trait loci (QTLs), over the past decade. The prospect beckons of tackling quantitative traits by transferring suites of alleles using mass application of the proven methods already used to improve qualitative traits. This will probably be possible one day, but not yet. One constraint is that the small effect of most QTLs may not be expressed in all physical or genetic environments. Another is that the accuracy of gene mapping to date often falls short of pinpointing exact markers. Scientists are addressing these constraints with ongoing research in functional genomics, the understanding of what each gene does.

Illustrating the promise of using molecular markers to breed for tolerance of abiotic stresses is work we are doing at the

International Rice Research Institute (IRRI) to develop submergence-tolerant rice varieties for the many low-lying rainfed areas of South and Southeast Asia periodically afflicted by uncontrolled flooding. Five days of complete submergence will destroy most rice crops, but some rice plants can survive under water for 2 weeks — plants whose low yields and poor grain quality, however, make them unsuitable as cultivars.

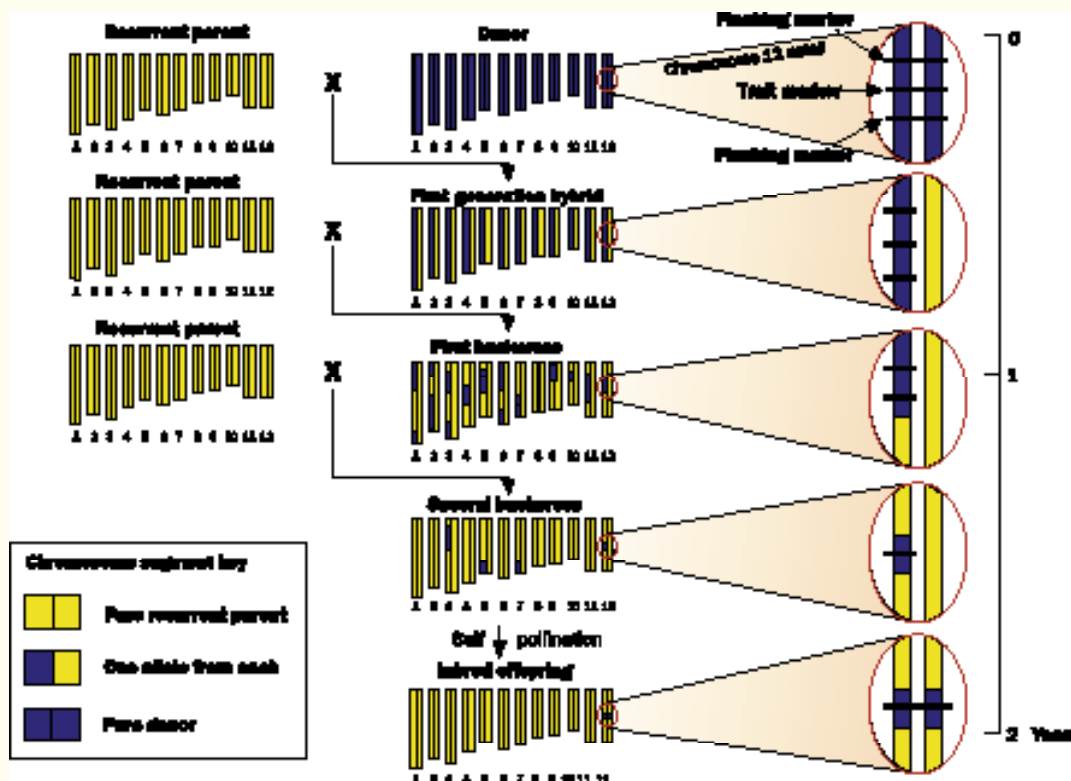
Submergence tolerance

The submergence tolerance displayed by one such plant, an Indian variety called FR13A, results mostly from a single gene. Careful molecular marking precisely mapped the location of the gene to a small segment of chromosome 9 now designated *Sub1* (short for “submergence”). The German government funding agency BMZ is supporting an IRRI project to transfer *Sub1* into at least six widely grown rice cultivars in Asia, including the

South Asian favorite Swarna and the popular IRRI variety IR64. We have nearly completed the process for Swarna and will send Swarna-*Sub1* plants to India for testing in 2005.

Success with *Sub1* encourages us to apply this strategy to other QTLs that have a relatively large effect. Fortunately, such potent QTLs exist for phosphorus uptake and tolerance of salt and aluminum toxicity, among other traits. An additional advantage of this technology is that it facilitates combining within popular varieties, in the manner of pyramiding, QTLs or alleles that counter several stresses. The goal is to breed cultivars with defenses against the array of stresses that routinely depress yield, and occasionally wipe out entire crops, in unfavorable rice-growing environments. Among these is the most widespread and damaging stress of all — drought. 🍌

Dr. Mackill is head of IRRI's Plant Breeding, Genetics and Biochemistry Division.



Marker-assisted selection. Rice breeders use molecular markers to track inheritance of the allele controlling the favorable trait they wish to transfer and to weed out progeny that inherit other donor genes. The result — in 2 years instead of 4 or more — is an improved cultivar exactly like the recurrent parent except that it possesses the transferred advantageous gene.

Pinning down rural poverty

by Suan Pheng Kam

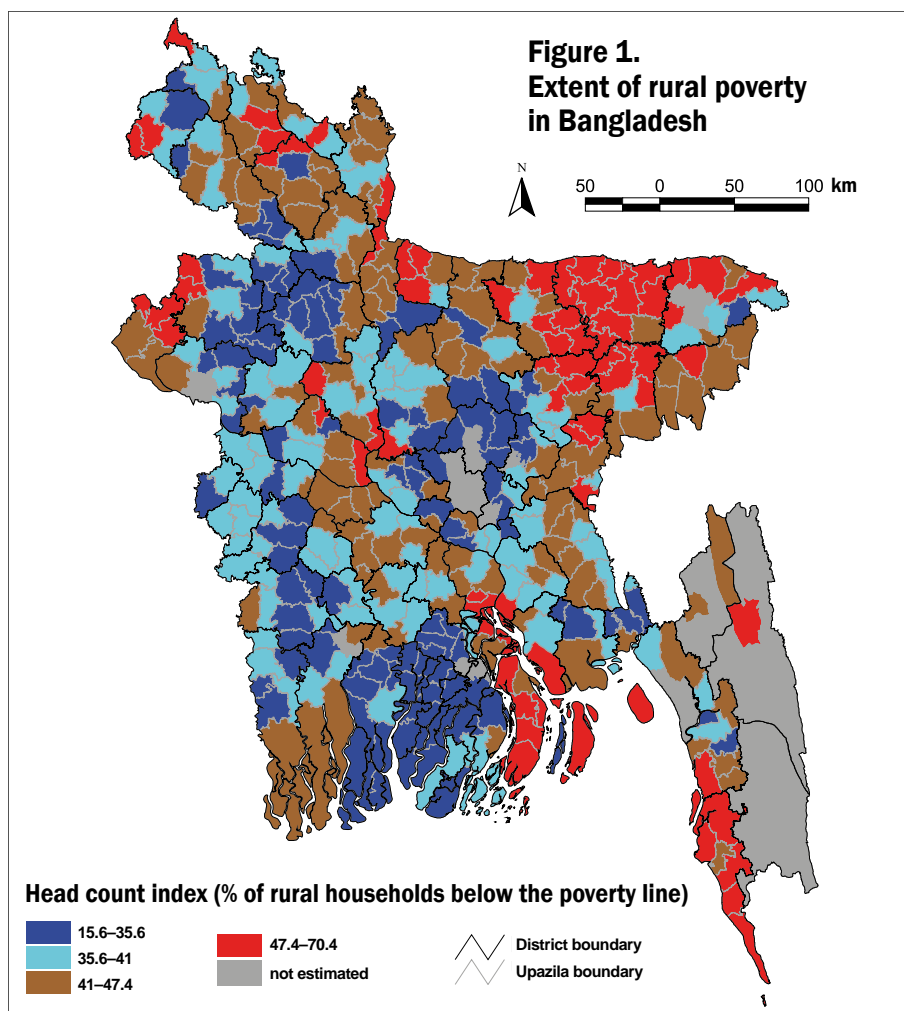
An innovative project to map poverty in Bangladesh points the way for programs targeting the rural poor

Inequities in living standards limit the prospects for political stability and economic health wherever they occur. The efforts of national governments to narrow these gaps are enjoying increased support as international agencies such as the World Bank and Asian Development Bank adopt development strategies focused on the poor. One resulting challenge is to channel resources effectively to those most in need.

The success of a pro-poor program hinges first upon being able to determine who the poor are and where they are concentrated. Identifying disadvantaged socio-economic groups within a specific geographic area is worthwhile, but the policy implications, such as wealth redistribution, are thorny. Mapping where the poor are concentrated spatially, on the other hand, clearly helps to refine development strategies and priorities. How precisely we manage to target areas for poverty alleviation depends on how finely we map poverty pockets. Then, how well we identify effective interventions to alleviate poverty depends on our understanding of which factors influence it most.

Target areas

In a project for Bangladesh partly funded by the Food and Agriculture Organization of the United Nations, researchers in the Social Sciences Division of the International Rice Research Institute (IRRI) are developing ways to identify and map in detail where the most disadvantaged rural Bangladeshis are concentrated. The purpose is



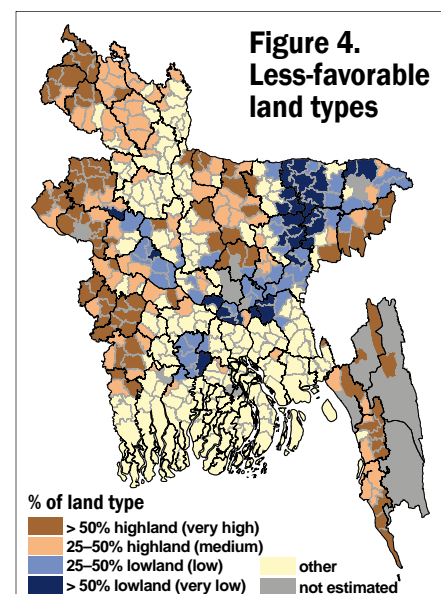
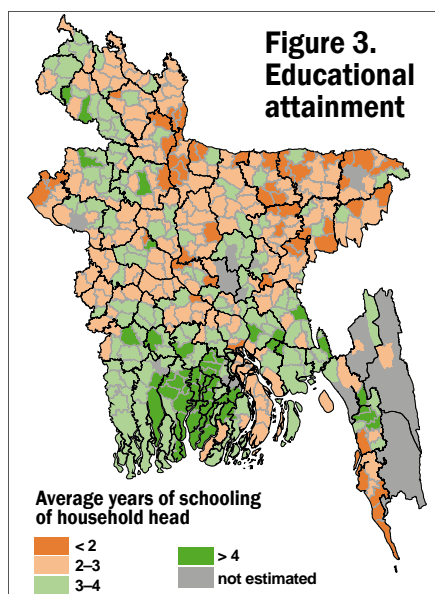
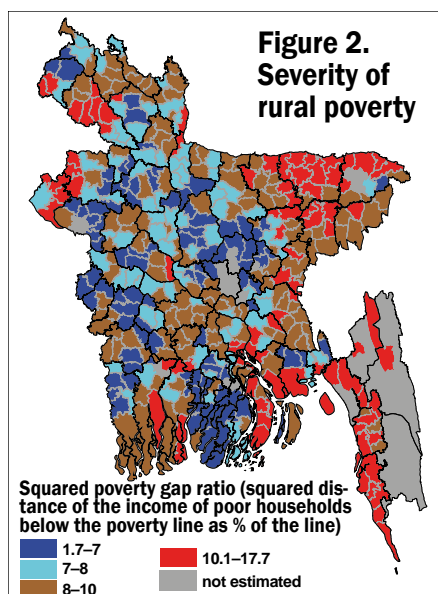
Notes: Figures 1 and 2 were computed by the Geographic Information Systems (GIS) Unit of IRRI's Social Services Division using small-area estimation combining a 62-village survey data set and 2001 population census data from the Bangladesh Bureau of Statistics (BBS); Figure 3 data source, 2001 population census, BBS; Figure 4 data source, Bangladesh Agricultural Research Council/Food and Agriculture Organization/United Nations Development Program Agri-export Zone Project; Figure 5 data source, GIS Unit, Local Government Engineering Department; Figure 6 data source, 2001 population census, BBS.

to determine target areas and priorities for agricultural research and development interventions.

Close collaboration with several key government agencies secured access to the diverse store of data they collect. We consolidated their data sets and applied analytical techniques to produce various indicators of human well-being. These include assets (financial, human and physical capital), opportunities (natural resource endowment, accessibility and migration), and vulnerability to natural disasters.

The most direct indicator of

poverty is income or expenditure, commonly measured through small sample surveys designed for aggregated estimates of the whole nation or for comparing rural and urban areas. Using statistical methods that combine detailed household data from surveys conducted in 2000-01 with geographically comprehensive data from the 2001 population census (which did not report income or expenditure), we can predict household incomes and estimate income poverty indicators at the subdistrict level. Bangladesh has 507 subdistricts, or *upazilas*,



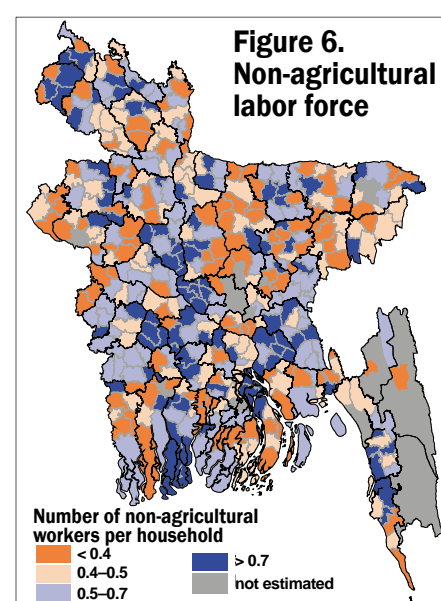
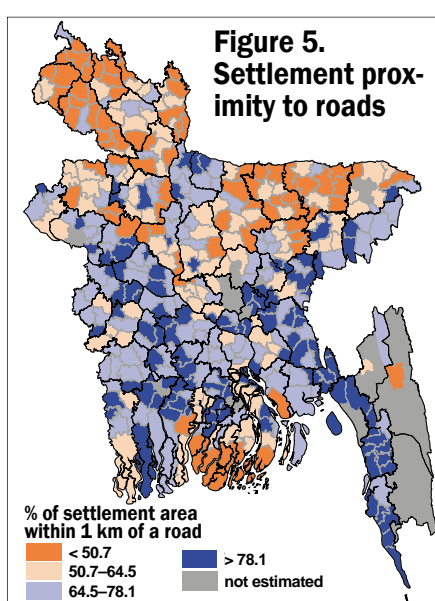
each averaging 280,000 residents.

Figures 1 and 2 show two common income poverty indicators mapped for rural *upazilas*. The head count index is the percentage of rural households below the poverty line, indicating the extent of poverty. The squared poverty gap ratio measures the severity of poverty — how far the poor are below the line. Both maps show distinct and similar patterns of rural poverty, with concentrations in the northwest and northeast, as well as in the Chittagong hilly areas of the southeast.

Pockets of poverty

We also mapped, by *upazila*, other indicators of human well-being that may influence the ability of households to earn a living. Figure 3 shows educational attainment, an indicator of human capital enhancing economic upward mobility. Figure 4 shows the distribution of less-favorable land types (low- and very low-lying land and highlands), an indicator of land resource endowment. Figure 5 depicts the proximity of settlements to roads, an indicator of accessibility to markets, educational and health services, and off-farm employment opportunities.

Comparing the maps suggests that the three main pockets of poverty in Figure 1 correspond with the less-favorable lands, occurrence of low educational attainment and poor access to roads. Preliminary statistical analyses confirm that these factors significantly determine



income poverty at the *upazila* level. The analyses further suggest that accessibility strongly influences the severity of poverty — but less so the extent of poverty, which is influenced more by educational attainment and irrigation availability. The policy implication is that improving accessibility to services would be a key intervention to benefit the poorest among the rural poor, while improving irrigation and education would help the rural poor to climb above the poverty line.

The poverty pockets in the northeast coincide with poor soils, flash-flooding from adjoining hills in India, and depressions where deepwater rice is traditionally grown during the rainy season. Farmers

in some of these areas now grow high-yielding *boro* (winter) rice with tubewell irrigation, abandoning the low-yielding deepwater rice. Despite this, and the high rate of migration of rural labor out of agriculture (Figure 6), these *upazilas* remain among the poorest in Bangladesh.

The high-poverty pockets in the northwest are associated with drought-prone highlands, poor accessibility and high labor participation in agriculture. Poverty alleviation in these areas would demand more concerted interventions to improve agricultural productivity. 🌾

Dr. Kam, a senior scientist in IRRI's Social Sciences Division, specializes in applying geographic information systems to sustainable natural resource management.

Farmers and diplomats

The International Rice Research Institute held two open days in early March to celebrate the International Year of Rice. The 3 March event attracted nearly 250 Filipino farmers and representatives of civil society. The 4 March event, for the Manila diplomatic and donor community, brought 39 guests representing 19 embassies, including the ambassadors of Bangladesh, the Czech Republic, Laos, Myanmar, New Zealand, Pakistan, Thailand and Vietnam.

IRRI Director General Ronald Cantrell marked the 10th anniversary of the Riceworld Museum and Learning Center by presenting a plaque to Dirk Rahlenbech, the German Embassy representative, in appreciation of the German government's unique contribution toward realizing the Riceworld dream (see *Rice revealed — with more in store* on page 18). Philippine government officials will have their own open day on 6 October.

COLORFUL BANNERS (below) greet visitors to IRRI. Joe Rickman (right), head of IRRI's Agricultural Engineering Unit, offers freshly milled rice for inspection to (from left) Peter Klingensteiner, country portfolio manager, German government funding agency GTZ; Myanmar Ambassador U Tin Htwin; Rodhy Taufiq, economic head, Indonesian Embassy; Carlos de Carvalho, deputy chief, Brazilian Embassy; Bangladeshi Ambassador M. Munir-uz-Zaman; Sylvia Ratnawati, educational culture head, Indonesian Embassy; Dirk Rahlenbech, third secretary, German Embassy; Somchit Philakone (hidden), wife of Lao Ambassador Phiane Philakone; C.R. Rajendran, director, Agriculture, Environment and Natural Resources Division, Mekong Department, Asian Development Bank; Zamshari Shaharan, second secretary, information, Malaysian Embassy; and Binh Slavicka, wife of Czech Ambassador Stanislav Slavicky. Lined up to greet visiting farmers are (from left) E.J. Azucena, Achu Arboleda, Lanie Quinto, Jenny Hernandez, Imee Aspiras and Bitu Avendaño.



International Year of Rice is the year of international rice awards

Nominations are still open for the *IRRN* Best Article Award, a special prize to mark International Year of Rice. The *International Rice Research Notes* editorial board and invited reviewers will consider for the award all submissions for publication received by *IRRN* between 1 August 2003 and 31 July 2004 that report on research conducted in a developing country and list a national agricultural research and extension system (NARES) rice scientist as the first author.

There will be up to six winning papers — one each on plant breeding; molecular biology and biotechnology; genetic resources; pest science and management; soil,

nutrient and water management; crop management and physiology; and socioeconomics — evaluated on the basis of scientific content, originality, relevance and organization. The first author of each winning paper will receive a US\$500 cash prize. Winning papers will be published in the December 2004 issue of *IRRN*. Publishing details are available at www.irri.org/publications/irrn/IRRNInstructions.asp and back issues at www.irri.org/publications/irrn/index.asp. Or contact *IRRN* Managing Editor Tess Rola at fax +63-2-580-5699 or +63-2-891-1174 or email t.rola@cgiar.org.

The International Koshihikari Rice Prize recognizes rice researchers

and extension specialists working at international, national and local agricultural research stations and universities. In celebration of the International Year of Rice 2004, the 500,000 yen (US\$4,500) prize will be awarded to two laureates at a ceremony scheduled for 4 November in Tokyo. The nomination deadline is 31 August. See the ad on page 35 for details.

Nominations for three other major competitions are now closed.

In support of the Food and Agriculture Organization (FAO) of the United Nations, IRRI announced on 5 April the International Award for Best Scientific Article. The lead authors of the winning entries — a scientific article focused on research on rice management and

focus on rice research



RESPECTED FARMER LEADER Jimmy Tadeo (*top right*) waves from a tractor-drawn gallery (*as in the inset*) during a tour of the IRRI Experiment Station. Bangladeshi Ambassador M. Munir-uz-Zaman (*above*) studies a computer monitor in a lab, as German Third Secretary Dirk Rahlenbech and Lao Ambassador Phiane Philakone look on. Farmers visit the cold storage vault (*left*) of the International Rice Genebank at IRRI.



ALLEEN DEL ROSARIO-RONDILLA, ARIEL JAVELLANA, PETER FREDENBURG



AL BENAVENTE

ARTISTS IN RESIDENCE. John Dyer, the painter in residence for the Eden Biodome Project in Cornwall, U.K., produced a series of paintings at IRRI celebrating International Year of Rice. He was accompanied by Tim Varlow, who did a series of black ink sketches of rice scenes such as harvesting and threshing.



another on rice improvement — will be invited to FAO headquarters in Rome on World Food Day, 16 October, to receive their awards.

All eligible entries are in for the FAO's global photography contest on the International Year of Rice theme, "rice is life." Many of the best entries will be posted at www.rice2004.org by 20 September, and the three winning photographers will likely be invited to Rome for World Food Day.

Nominations are closed for the 2004 Senadhira Rice Research Award, but this is an annual prize open to any rice scientist employed by a NARES partner of IRRI or citizen of a rice-growing country in Asia. Any NARES institute or university, or any other

scientific organization, may nominate scientists who have made outstanding contributions to rice research, such as developing successful varieties, publishing scientific papers, or accomplishing any other tangible contribution to rice development. See www.irri.org/docs/Senadhira.pdf for details.

- The *Journal of Food Composition*

and *Analysis* is assembling a special theme issue in honor of the International Year of Rice for release in the last quarter of the year. The journal is the official publication of the International Network of Food Data Systems and is cosponsored by the United Nations University and FAO.

Thailand confab looks at trade

Almost 250 decision-makers in the international rice trade attended the 4th annual Thailand Rice Convention 2004 in Bangkok on 26-27 May. Organized by the Thai Rice Exporters Association and the Thai Department of Foreign Trade, the convention was the first major event of the International Year of Rice 2004 aimed at the international rice trade.

The event attracted special interest because of the recent upward trend in world rice prices and growing interest in China's declining rice production and its potential impact on the international rice trade.

In remarks during a panel discussion on the opening day, Vichai Sriprasert, president of the Thai Rice Exporters Association, said one of the keys to the continuing success of the international rice trade was maintaining little or no government interference.

That said, Thai rice is not expected to be one of the products enjoying significant trade liberalization in the wake of

proliferating bilateral and regional free-trade agreements. The reason, according to Narongchai Akaraseranee, a veteran economist and adviser to Thai Finance Minister Somkid Jatusripitak, is that rice is politically sensitive.

In comments published in the 27 May edition of the *Bangkok Post*, Narongchai said that, even under the ASEAN Free Trade Area (AFTA), on which work began more than a decade ago, members have moved very slowly to open their rice markets. For example, Malaysia and Indonesia have committed only to cut import tariffs on rice to 20% by 2010, and the Philippines to 70% in the same year. These figures are much less than the target rate of 0-5% for most other products traded in the region.

However, the *Bangkok Post* added, there might be a slight positive impact on trade with China and Australia, two of eight countries that are Thailand's counterparts in bilateral free-trade areas. China, with or without a trade pact, is forced by necessity to import some rice from Thailand. In the case of Australia, the import duty on rice will be cut to zero immediately when the pact with Thailand takes effect on 1 January next year — though, of course, rice consumption in Australia is very low.

"I would conclude that FTAs have had very little impact [on Thailand's rice trade] in general," Narongchai reportedly said at a convention seminar. Narongchai's view is at

odds, said the *Bangkok Post*, with the contention of state authorities, who are convinced that Thai rice will have improved access to other markets after securing closer trade ties under free-trade areas.

Thailand is in various stages of bilateral free trade talks with Bahrain, India, Japan, New Zealand, Peru and the U.S. The kingdom also belongs to two regional free-trade areas: AFTA and BIMSTEC (for Bangladesh, India, Myanmar, Sri Lanka and Thailand Economic Cooperation, which Bhutan and Nepal have just joined).



THE KOREAN MINISTRY of Agriculture and Forestry (MAF) launched its celebration of International Year of Rice at the Agricultural Trade Center in Seoul on 28 May. Six hundred participants, including ambassadors of many countries, stakeholders, civil society representatives, administrators and agricultural scientists attended the event. "Our hope and purpose is to ensure the sustainability of agriculture as the basis for renewing our rural areas as clean, stable communities," said Minister of Agriculture and Forestry Sang-Man Heu in his opening remarks. "Let us use the United Nations' declaration of International Year of Rice to realize the importance of rice and agriculture in our society." Admiring a rice-seedling display are (front, from left) an unidentified guest; D.G. Chung, president of the National Agricultural Cooperative Foundation; W.S. Chang, chairman of the Presidential Committee on Agriculture, Fisheries and Rural Policies; S.H. Kim, former minister of education; Minister Heu; H.P. Moon, deputy administrator of the Rural Development Administration; R.K. Park, former director general of the National Institute of Crop Science (NICS); (back, from left) S.H. Lee, director general of the MAF's Bureau of Food Policy; V.V. Fen, ambassador of Uzbekistan; and M.H. Lee, NICS director general.

HYEUNGYUN PARK/RDA



THE AUSTRALIAN RICE INDUSTRY is one of the most efficient and productive in the world, feeding 40 million people every day, noted John Anderson, deputy prime minister of Australia, as he unveiled an 80x100 cm rice sculpture in the form of Parliament House at a ceremony marking the official Australian launch of International Year of Rice at Parliament House in Canberra on 25 March. Shown standing behind the sculpture with Laurie Arthur (left), president of the Ricegrowers' Association of Australia, and Gerry Lawson (right), chairman of SunRice, the deputy prime minister said: "I know some people watch Parliament on television as if it's a popular serial. Now I suppose it really is one."

CLARE SIDINGS



MINISTER OF COMMERCE Watana Muangsook opens the Thailand Rice Convention with a sickle.

Vietnam launches year, awards rice leader

The Vietnamese Ministry of Agriculture and Rural Development on 31 May joined the Food and Agriculture Organization of the United Nations and IRRI in launching the International Year of Rice in Hanoi. The ministry formed a committee to coordinate year activities, including the Mekong Rice Conference in Ho Chi Minh City on 15-17 October, a rice-farming contest, a rice-cooking festival, and an exhibition on scientific advances in rice cultivation.

Addressing the launch ceremony, Deputy Minister Bui Ba Bong said Vietnam — the world's fifth-largest rice producer, with an annual output of 34.5 million tons — is willing to cultivate international cooperation in this field. "Rice production in the country has been expanding over the past 20 years, with annual increases of nearly 1 million tons in output and 2 t/ha in productivity," he said, adding that this achievement has helped

ensure food security for this country of 80 million people and maintain rice exports of 3.5-4 million tons per year.

On the same day, Vietnam gave IRRI Director General Ronald P. Cantrell its Medal for Agriculture and Rural Development in recognition of his contributions to agricultural development and research over the years. The award cites not only his contributions at IRRI since 1998, but also as director in 1984-90 of the Maize Program at the International Maize and Wheat Improvement Center in Mexico.

Receiving Dr. Cantrell in Hanoi, Deputy Prime Minister Nguyen Tan Dung praised IRRI's support for agricultural development in Vietnam, especially in research, training and the transfer of improved rice varieties. He stressed the high priority that Vietnam places on



DUNCAN MACINTOSH (2)



DR. CANTRELL, accompanied by his wife, Pam, receives an award from Deputy Minister for Agriculture and Rural Development Bui Ba Bong and (left) shakes hands with Deputy Prime Minister Nguyen Tan Dung as IRRI Senior Scientist T.P. Tuong looks on.

agricultural research and development and his hope that Vietnam-IRRI cooperation will continue. In response, Dr. Cantrell praised Vietnam's national renewal, especially its achievements in agricultural development and poverty alleviation.

Laos celebrates at national center

A celebration of the International Year of Rice on 8 April attracted to the Lao National Agricultural Research Center in Saithani, Vientiane, 100 guests, including Siene Saphangthong, minister of agriculture and forestry and former IRRI board member (1996-2001), members of the national assembly, and government ministers.

April also saw work begin on a video, jointly produced by IRRI and Lao TV, on rice in Laos and the cooperation enjoyed over the past 14 years by IRRI, the Swiss Agency for Development and Cooperation, and the Lao Ministry of Agriculture and Forestry. Completion of the video is expected in September.

In October, Laos will celebrate a special rice day, possibly coinciding with International Food Day on 17 October. Prime Minister Bounnhang Vorachit will be the chief guest and convener of the event, which will take place at the Ministry of Agriculture in the morning and move to the National Agricultural Research Center in the afternoon. The following month, the ASEAN Plus Three Summit will take place in Vientiane, with a special rice exhibition mounted at the conference center.

Ongoing activities throughout the year include the IRRI-Rockefeller Edutainment Project encouraging farmers to avoid early insecticide spraying, plans to launch a radio series on IPM for rice, and Lao Radio and TV special reports on rice.



International Koshihikari Rice Prize

Call for nominations

The International Koshihikari Rice Prize was established in 1997, the 50th anniversary of the Fukui Agricultural Experiment Station's rice-breeding program. The station's development of the rice variety *Koshihikari*, one of the best varieties in Japan, was an excellent example of the contributions local agricultural experiment stations make to rice production.

The prize recognizes rice researchers and extension specialists working at international, national and local agricultural research stations and universities.

In celebration of the International Year of Rice 2004, the prize will be awarded to the two best candidates. Each Koshihikari laureate will be awarded 500,000 Japanese yen during an award ceremony scheduled for 4 November 2004 in Tokyo, Japan. As part of the ceremony, the laureates are asked to make a presentation about their achievements in rice research and extension.

The nomination deadline is 31 August 2004. For more information and access to the online nomination form, go to www.irri.org/docs/Koshihikari.pdf. All inquiries about nominations and procedures should be directed to the secretariat by email to ta1938@hotmail.com.

Year achieves high profile in Nepal

Awareness of International Year of Rice got off the ground in Nepal when the English-language *Nepali Times* newspaper carried in its 6-12 February edition features on varietal preservation, especially of wild rice, and Golden Rice, as well as a commentary by IRRI Director General Ronald Cantrell. Nepal Television offered news of the year on 10-11 March.

On 23 March, King Gyanendra Bir Bikram Shah Dev inaugurated a 4-day conference of the Royal Nepal Academy of Science and Technology, which included a rice exhibition set up by the Nepal Agricultural Research Council (NARC), which received Nepal Television news coverage on 24 March. The next day, Bhola Man Singh Basnet, chief of the Communication, Publication and Documentation Division of NARC, gave a live radio interview on International Year of Rice for the Himalayan Broadcasting Company.

April saw an orientation and



training on the Nepal country site of the online Rice Knowledge Bank, NARC Executive Director R.P. Sapkota informing Minister for Agriculture and Cooperatives P.C. Lohani about the year, and the publication on 30 April of a full-page Friday supplement on the year in the *Rising Nepal*.

Then-Prime Minister Surya Bahadur Thapa inaugurated on 5 May a Nepal Development Forum exhibition, at which NARC participated with a rice year theme. Two days later brought the 13th



IN KATHMANDU, Bhola Man Singh Basnet looks on as King Gyanendra Bir Bikram Shah Dev inspects an item in rice exhibit in March and (above) makes a point to the prime minister at another exhibition in May.

NARC Day and an exhibition celebrating the year. A special issue of the NARC Newsletter in May focused on International Year of Rice.

NARC had an exhibit at the 22-24 May International Biodiversity Day in Kathmandu and planned for one at the 5-7 June Ministry of Environment and Population event in the capital marking International Environment Day, as well as for a special focus on the year at the 28-30 June National Summer Crops Workshop at Khumaltar, Lalitpur, Nepal.

Broad-based steering committee at the helm in Bangladesh

The Bangladesh Ministry of Agriculture has formed a 14-member steering committee for International Year of Rice led by Abdur Rashid Sarkar, additional secretary.

Under committee coordination, the Directorate of Food will organize farmers field days focused on marketing issues and a workshop on rice milling, and the Agriculture Information Service will publish a special rice feature in the monthly *Krishikatha* and a pamphlet. The Bangladesh Rice Foundation will hold seminars on opportunities and challenges facing the Bangladeshi rice industry — including the potential for exporting fine-quality rice and the impact of trade liberalization — and on the cultural dimensions of rice. The Bangladesh Agricultural Research Council will hold a seminar on prosperity through rice. The NGO Affairs Bureau will motivate farmers

to use high-yielding rice seed while promoting policy initiatives to protect traditional rice varieties.

IRRI organized workshops on poverty mapping on 3 March (see *Pinning Down Poverty* on page 30), technology uptake methods and pathways on 18-19 April, and technology development on 16 May.

The Bangladesh Rice Research Institute scheduled workshops,

exhibitions and seminars on a range of topics, including rice history, policy, and present and future demand. Finally, the Department of Agricultural Extension scheduled seminars on rice culture, globalization, and gender and rice; a meeting for 3,000 farmers in October; and district-level seed fairs and art competitions in November and December.

Manila anticipates International Rice Summit

The Philippine International Year of Rice National Committee has set in motion plans for an International Rice Summit on 29-30 November in Manila. The summit aims to bring together several of world's foremost rice experts to discuss rice in terms of culture, trade, development and production. President Gloria Macapagal Arroyo in February declared November to be National Rice Awareness Month, and the Philippine National Rice Summit will take place in or near Manila just before the international event. Also planned is a parallel international rice festival. Track developments at www.philrice.gov.ph/IYRPhil and look for details in the October-December issue of *Rice Today*.

- The Asia Rice Foundation, Philippines, announced in June a photo contest on the year theme "rice is life." The deadline for entries is 15 August. See www.asiarice.org/sections/chapters/philippines/photocontest.html for details.

Gathering momentum in India

The Indian Council of Agricultural Research (ICAR), the Directorate of Rice Research (DRR) and their partners in India are conducting various International Year of Rice activities to enhance public awareness about rice, promote the exchange of scientific information and ideas, and motivate stakeholders, thus paving the way for sustainable rice production able to ensure household food security.

The DRR observed on 28 February, at its research campus in the Rajendranagar district of Hyderabad, National Science Day with an International Year of Rice theme. The directorate welcomed 450 children from high schools in and around Rajendranagar to visit such DRR facilities as the rice museum, greenhouses and farm implements section. Teams from different schools competed in a special quiz competition on the subject of "rice in India." The day ended with an address from Project Director B. Mishra, who awarded prizes to the contest winners.

The DRR organized on 2 April as another International Year of Rice activity Technology Display Day, which attracted more than 250 farmers. The event coincided with the directorate's 38th foundation anniversary. Padmashri I.V. Subba Rao delivered the foundation lecture, and Foundation Day awards were presented.

In New Delhi, the 39th All India Rice Research Group Meeting took place on 12-14 April at the Indian Agricultural Research Institute. More than 450 rice scientists participated, deliberating on the results of 2003 and formulating the technical

program for 2004. Mangala Rai, secretary of the Department of Agricultural Research and Education and director general of ICAR, inaugurated the meeting.

A poster display at the meeting venue conveyed the latest developments in rice research. In 2003, the Central Variety Release Committee (CVRC) released three varieties, and state release committees released another 10 varieties. Three hybrids and five inbred varieties were identified for submission to the CVRC. Dr. Mishra received the Rao Bahadur Dr. Ram Dhan Singh Memorial Award for 2002-03 for his significant contributions to developing salt-tolerant rice varieties such as *CSR10*, *CSR13*, *CSR23*, *CSR27* and *CSR30* (*Yamini*).

Also in New Delhi, the 9th meeting of the National Rice Biotechnology Network took place on 15-17 April at the National Agricultural Science Complex. The meeting attracted over 175 scientists, who reviewed the progress of research on rice biotechnology since the 8th meeting in 2001 in Aurangabad. Chairing the inaugural session was M.K. Bhan, secretary of the Department of Biotechnology. In his inaugural address, ICAR Director General Rai mentioned that the council will continue to support the rice biotechnology program and suggested that the network meeting should be a regular component of future annual rice group meetings. Products of marker-aided selection are now available for national testing under the Coordinated Program.

Originally scheduled for 17-18 March, the National Workshop on Boro Rice, aiming to enhance the productivity of boro rice, was postponed to 18 August at the request of the state government of Tripura to accommodate the general



NATIONAL SCIENCE DAY in February (from top) gives high-school girls a close look at rice in a Directorate of Rice Research greenhouse, quiz winners awards from Project Director B. Mishra, and a crowd of high-school boys a hands-on demonstration.



election. The National Symposium on Strategies for Enhancing Export of Quality Rice, scheduled to take place in Hyderabad in June, aimed to address relevant research, policy and control issues.

Events planned for the coming months are special rice days organized by state departments of agriculture in August and September for the display and extension of rice technology; an international symposium on Rice: Green Revolution to Gene Revolution on 4-6 October in Hyderabad, which will offer a retrospective of rice research and a look at what the future holds for nutrition and food security; and a seminar on Drudgery Reduction for Women in Rice Farming, organized by the National Research Council on Women in Agriculture in Bhubaneswar.

More than 20 publications on various aspects of rice are planned for release during the year.

Around the world, from Osaka to Tokyo

Between the **World Wild Rice Forum** in Osaka on 8 August (see ad opposite) and the **World Rice Research Conference** in Tokyo on 4-7 November (see ad on back cover), a world of year-themed rice meetings is taking place.

Seoul, South Korea, will be the venue for a meeting of the Council for Partnership on Rice Research in Asia (**CORRA**) on 10-12 September, followed by the **International Rice Science Conference** on 13-15 September. Organized by the Korean Ministry of Agriculture and Forestry, the Rural Development Administration and IRRI on the theme Rice Science for Human Welfare in the 21st Century, the conference will have four sessions: 1) increasing potential rice yields, 2) ecofriendly and sustainable rice-cultivating methods, 3) improving the grain quality and nutritional value of rice, and 4) the social and economic impact of rice cultivation. For details, contact: Dr. K.S. Lee, National Institute of Crop Sciences, klee@rda.go.kr, or Dr. K.L. Heong, IRRI, k.heong@cgiar.org. There follows a meeting of the **IRRI Board of Trustees** on 15-17 September.

September will also see the **Rice for the Future Conference** in Bangkok on 31 August-2 September; the Huaihua International Forum for **Hybrid Rice and World Food Security** in Changsha and Huaihua, China, on 8-10 September; and an international conference on **Challenges and Opportunities for Sustainable Rice-based Production Systems** in Torino, Italy, on 13-15 September, organized by the Medrice Network (www.medrice.unito.it/Invitation_1.doc).

October ushers in the International Symposium on Rice: **From Green Revolution to Gene Revolution** in Hyderabad on 4-6 October; the **International Cooperation Festival** in Tokyo on 2-3 October; **German Tropical Day** in Berlin on 5-7 October; the **World Food Prize** events in Des Moines on 14-15 October (see *World food reprise* on page 12); the **Mekong Rice Conference** in Ho Chi Minh City on 15-17 October (see ad on page 39); **World Food Day** at the UN General Assembly in New York and FAO headquarters in Rome on 16 October; and the **CGIAR Annual General Meeting** in Mexico City on 25-29 October.

OTHER CONFERENCES, MEETINGS, WORKSHOPS AND TRAINING

Event	Contact	Date/Location
Training@IRRI	www.training.irri.org , IRRI-Training@cgiar.org	Los Baños, Philippines
Training Course on Environment and Sustainable Development	pradhan@un.org , www.rrcap.unep.org/tongji	26-31 Jul / Shanghai, China
GIS Short Course: Introduction to GIS Applications in Soil and Water Sciences	spborneman@ifas.ufl.edu , http://conference.ifas.ufl.edu/soils/gis/index04.html	28-30 Jul / Gainesville, USA
31st Annual Meeting of the Plant Growth Regulation Society of America	www.griffin.peachnet.edu/pgrsa/events.html	31 Jul-4 Aug / Charleston, USA
American Society of Agricultural Engineers Annual International Meeting	www.asae.org/meetings/index.html	1-4 Aug / Ottawa, Canada
2nd International Conference and Field Workshop on Soil Classification	http://biology.krc.karelia.ru/soil04	3-9 Aug / Petrozavodsk, Russia
12th International Symposium on Insect-Plant Relationships	www.biologie.fu-berlin.de/SIP12-Berlin	7-12 Aug / Berlin, Germany
The XXIII Nordic Hydrological Conference	nhc-2004@emhi.ee , www.emhi.ee/english/English_Hydr_Inter_new.php3	8-12 Aug / Tallinn, Estonia
Conf. of the Asian Fed. of Information Technology in Agriculture and Congress on Computers in Agriculture and Natural Resources	apaari@apaari.org , www.afitaandwcca2004.net	9-12 Aug / Bangkok, Thailand
IFDC 2004: Agricultural Input Regulatory Systems	hrd@ifdc.org , hrdu@ifdc.org , www.ifdc.org 16-20	15-20 Aug / Pretoria, South Africa
XXII International Congress of Entomology – Strength in Diversity	ice2004@ccm.com.au , www.ice2004.org	15-21 Aug / Brisbane, Australia
World Library and Information Congress: 70th IFLA General Conference and Council	www.ifla.org/IV/ifla70/index.htm	22-27 Aug / Buenos Aires, Argentina
14th Congress of Federation of European Societies of Plant Biology	www.zfr-pan.krakow.pl/konf	23-27 Aug / Krakow, Poland
13th International Congress on Photosynthesis Genomics Momentum 2004	www.uqtr.ca/ps2004 plaza@genomicsmomentum2004.org , www.genomics.nl/genomics_momentum_2004	29 Aug-3 Sep / Montreal, Canada 30 Aug - 1 Sep / Rotterdam, Netherlands
12th International Conference on Weed Biology	gasquez@dijon.inra.fr , www.dijon.inra.fr/malherbo/AccueilF1.htm	31 Aug-2 Sep / Dijon, France
Beijing International Book Fair	www.bibf.net	2-6 Sep / Beijing, China
International Web-based MIS Training Workshop	http://home.wanadoo.nl/hwebber/localstart.html	6-10 Sep / The Hague, Netherlands
7th European Conference on Agriculture and Rural Development in China: Agriculture and Rural Development in China	t.g.cannon@greenwich.ac.uk	8-10 Sep / London, U.K.
European Association for Research on Plant Breeding 17th General Congress	www.eucarpia.org	8-11 Sep / Tulln, Austria
2004 World Fertilizer Conference	lmabee@tfti.org , www.tfti.org/Meetings/worldfertilizerconference.asp	12-14 Sep / San Francisco, USA
Self-Sustaining Solutions for Streams, Wetlands and Watersheds	sowden@asae.org , www.asae.org/meetings/streams2004/Index.html	12-15 Sep / St. Paul, USA
Hydric Soils: Specialized Training for Wetland Specialists	spborneman@ifas.ufl.edu , http://conference.ifas.ufl.edu/soils/hydricsoils/index04.html	14-16 Sep / Gainesville, USA
North American Weed Management Assoc. Conference and Trade Show	scottg@co.pennington.sd.us , www.nawma.org	20-23 Sep / Rapid City, USA
18th International Conference of Plant Growth Substances	apaari@apaari.org , www.conlog.au/ipgsa2004	20-24 Sep / Canberra, Australia
4th International Crop Science Congress	4icso04@im.com.au , www.cropscience2004.com	26 Sep-1 Oct / Brisbane, Australia
Automation Technology for Off-Road Equipment	www.asae.org/meetings/atoe04/index.html	7-8 Oct / Kyoto, Japan
2nd Shanghai International Library Forum: City Development and Library Service	mwu@libnet.sh.cn	12-16 Oct / Shanghai, China
3rd International Caribbean Conference 2004: Hybrid Cultures in the Atlantic: Relations between Africa, Asia, Brazil and the Caribbean	ocabrera@fchf.ufg.br , www.h-net.org/announce/show.cgi?ID=136142 , www.fchf.ufg.br	20-24 Oct / Goiania, Brazil
International Conference on Pesticide Application on Drift Management	http://pep.wsu.edu/Drift04	27-29 Oct / Waiakoloa, USA
2004 American Society of Agronomy/ Crop Science Society of America/Soil Science Society of America Annual Meetings	www.asa-cssa-sssa.org/anmeet	31 Oct-4 Nov / Seattle, USA
AWRA's 2004 Annual Water Resources Conference	www.awra.org/meetings/Orlando2004/index.html	1-4 Nov / Orlando, USA
Entomological Society of America Annual Meeting	esa@entsoc.org , www.scisoc.org	7-11 Nov / Salt Lake City, USA
25th Annual International Irrigation Show	www.conferencealerts.com/seeconf.mv?q=ca1hmi0	14-16 Nov / Tampa, USA
Canadian Weed Science Society Annual Meeting	www.cwss-scm.ca/coming_events.htm	29 Nov-1 Dec / Winnipeg, Canada

Rice, the Environment and Livelihoods for the Poor

Toward achieving the Millennium Development Goals in the Mekong River Basin, a quarter of whose 60 million people live in poverty

- ★ Study how the basin's rich diversity of resources, cultures and environments can be applied to make rice farming more productive, profitable and sustainable
- ★ Employ and develop the "learning across boundaries" strategy with discussions on accelerating farmers' adoption of improved technologies
- ★ Establish a platform for partnerships among stakeholders and policymakers in agriculture, health and rural development



Mekong Rice Conference 2004

15-17 October 2004
Ho Chi Minh City
Vietnam

Organized by the
Ministry of Agriculture
and Rural Development
of Vietnam

Registration and
information:
www.irri.org/MRC2004



World Wild Rice Forum 2004

8 August 2004 1-4 pm

Asian Wild Rice Music Festival

8 August 2004 4-6 pm

Promoting the conservation of wild rice in the wild

Wild rice is an indispensable storehouse of rice biodiversity. Come celebrate this vital resource during International Year of Rice 2004 at an international forum and music festival!

Organized by the Wild Rice Club of Japan
(Shigeru Matsunami, chairman)
in association with the
International Rice Research Institute
(Keijiro Otsuka, board chair),
TARF and NPOB.B.A.
with support from DyDo Drinco, Inc.

Venue:
Grand Cube Osaka
(Osaka International Convention Center)
5-3-51, Nakanoshima Kita-ku, Osaka
530-0005 Japan
tel +81-6-4803-5555
fax +81-6-4803-5620

Music festival
Sports center in Utsubo Park, 1F
1-9-3 Utsubo-Honmachi, Nishi-ku, Osaka

Contact:
Shigeru Matsunami
World Wild Rice Forum
4-2-21, Kashima, Yodogawa-ku
Osaka, Japan
tel (+81-6) 6301-1108, fax (+81-6) 6307-4626

Darshan Brar (d.brar@cgiar.org)
International Rice Research Institute
DAPO Box 7777,
Metro Manila, Philippines
tel (+63-2) 580-5600, fax (+63-2) 580-5699

Philippine president honors agronomist



S.K. De Datta, former IRRI agronomist and principal scientist, has received a Presidential Citation Award recognizing his contributions toward eradicating hunger through improved agricultural productivity and food security, particularly in the production

of rice. On behalf of Philippine President Gloria Macapagal Arroyo, Luis P. Lorenzo, secretary of agriculture, presented the award to Dr. De Datta on 13 April at the 17th Philippine Rice Research Institute National Research and Development Conference.

Currently the associate provost for international affairs at Virginia Tech in Blacksburg, Virginia, Dr. De Datta worked at IRRI from 1964 to 1991, heading its agronomy department from 1966 to 1989. From 1989 to 1991, he helped lead the Rainfed Lowland Rice Ecosystem program.

Dr. De Datta's research on rice led to significant changes in world rice production and contributed to the development and 1966 release of high-yielding IR8, the "miracle rice" that launched the Green Revolution in Asia and helped avert an impending food crisis (see the January 2004 issue of *Rice Today*, Vol. 2 No. 2, pages 10-19). His work to improve rice production methods led to direct seeding of rice, replacing in many areas the age-old transplanting method of rice propagation. This innovation has enabled many rice farmers to produce three crops per year with less labor on fields that previously yielded only one annual crop.

• **President Gloria Macapagal Arroyo** was herself honored on 20 February with the Ceres Medal from Jacques Diouf, director general of the Food and Agriculture Organization of the United Nations. The Ceres Medal, named for the Roman goddess of agriculture, has been awarded since 1971 to distinguished women who have contributed to the fight against hunger. Recipients have included former Bangladeshi Prime Minister Sheikh Hasina, Panamanian President Mireya Moscoso, former Brazilian First Lady Ruth Cardoso and Mother Teresa. President Arroyo is the first Filipina to receive the prestigious award.

Keeping up with IRRI staff

Tom Mew and **Sant Virmani** have been appointed principal scientists in recognition of their contributions to IRRI and rice research.

In his 29 years at the institute, Dr. Mew, who in March stepped down as head of the Entomology and Plant Pathology Division, has made major contributions in a wide range of areas, in particular seed health and pest control through crop biodiversity. Dr. Mew received further recognition for his contributions to rice pathology on 28 April, when he received a Certificate of Appreciation from the South Korean Rural Development Administration.

Sant Virmani, deputy head of IRRI's Plant Breeding, Genetics and Biochemistry Division, has been at IRRI for 28 years, developing and disseminating hybrid

rice technology, primarily for the tropics. At the 8-12 March Crop Science Society of the Philippines (CSSP) annual scientific conference in Davao City, the inaugural Dr. S.S. Virmani Award for Development and Dissemination of Hybrid Crop Varieties in the Philippines — implemented following a 110,000 peso (US\$2,000) donation from Dr. Virmani to the society — was presented to **Danila Tumamao**, an agriculturalist from Isabela Province.

Glenn Gregorio, a plant breeder now completing a 4.5-year stint as an IRRI international research fellow, received at the same CSSP conference the 2004 Achievement Award for Crop Science Research. Dr. Gregorio was cited for his outstanding contributions to research and development into breeding rice varieties with tolerance of salinity and other abiotic stresses and



Partners in progress

Meryl Williams, former director general of the WorldFish Center, took up her position on 1 May as the first executive officer for the newly created Future Harvest Alliance Office. The alliance aims to give policy and administrative support to collaboration among the centers of the Consultative Group on International Agricultural Research.

John Dodds has been named the new

enhancing the nutritional value of rice for human health.

Florencia G. Palis led a team of IRRI scientists who won the Best Paper on Education and Extension Award at the CSSP conference. Dr. Palis coauthored *A farmer-participatory approach in the adaptation and adoption of controlled irrigation for water saving: A case study among rice farmers in Canarem, Victoria, Tarlac* with P.A.A. Cenas, B.A.M. Bouman, R.M. Lampayan, A.T. Lactaoen, T.M. Norte, V.R. Vicmudo, M. Hossain and G.T. Castillo.

Melissa Fitzgerald joined IRRI in April as an international research fellow heading up its new Grain Quality and Nutrition Research Center. Dr. Fitzgerald previously worked at the New South Wales Department of Agriculture and the Yanco Agricultural Institute in Australia.

Martin Gummert has rejoined IRRI as the Agricultural Engineering Unit's post-harvest development officer. He will help form a network to improve postharvest systems in rice production throughout Southeast Asia.

Christian Witt, former IRRI affiliate scientist in soil science, is the new Singapore-based director of the Southeast Asia Program of the Potash and Phosphate Institute, Potash and Phosphate Institute of Canada, and International Potash Institute.

Sarah Johnson joined IRRI's Crop, Soil and Water Sciences Division in April. Dr. Johnson, a soil chemist, will work on the project Managing Crop Residues for Healthy Soils in Rice Ecosystems.

Daniele Marechal, IRRI's second Australian Youth Ambassador for Development, arrived in March to work in Communication and Publications Services.

Cathy Staloch received the World Food Prize Youth Institute 2003 John Chrystal Award for her work at IRRI as a 2002 Borlaug-Ruan Intern.

Albert Atkinson, training and courseware specialist, left IRRI in May to work for the Asian Development Bank.

Thanda Wai, intellectual property rights specialist, left the institute in May.

deputy director for research at the International Maize and Wheat Improvement Center in Mexico. Dr. Dodds, formerly assistant director general for research at the International Center for Agricultural Research in the Dry Areas, was scheduled to begin his new position on 1 June.

James W. Jones, a professor at the University of Florida's Institute of Food and Agricultural Sciences, is the new chairman of the Board of Trustees of the International Center for Tropical Agriculture.

Rice to the tiller

by DAVID DAWE
Economist

Lower prices can put more rice in the bowls of the landless rural poor — the forgotten, anonymous and voiceless underclass that provides most of the labor to grow it

Perhaps surprisingly, farmers do not perform most of the labor on rice farms in South and Southeast Asia. In the Philippines and on the Indonesian island of Java, for example, rice farm families work on average less than 40 days per year on the fundamental tasks of growing rice. If both husband and wife share this labor, each averages 13 hours per month.

This is good for farmers because growing rice is hard work. Plowing 1 ha with a water buffalo requires the farmer to slog 30 km through shin-deep, clinging mud, all the while muscling the reins and plow — just for one pass. Transplanting 1 ha of rice by hand means bending over to place up to a quarter million separate hills.

Relief from this backbreaking labor has not come from mechanization. Most of the work is done by often-forgotten rural laborers who are landless or own only a tiny plot just big enough for a hut. They work land owned by others to make ends meet. China and Vietnam are exceptions, as radical land reforms many years ago mean that farm families there satisfy most of their own labor needs. But in India, Indonesia, Bangladesh and the Philippines, hired workers provide the vast bulk of labor on rice farms.

Landless laborers are numerous in these countries. In Bangladesh, nearly half of rural residents own insufficient land to grow enough rice to feed family members even half the amount that the average Bangladeshi consumes. In the Philippines,



Percentage of hired labor in total labor use for rice cultivation.

Moya PF, Dawe D, Pabale D, Tiongco M, Chien NV, Devarajan S, Djatiharti A, Lai NX, Niyomvit L, Ping HX, Redondo G, Wardana P. 2004. The economics of intensively irrigated rice in Asia. In: Dobermann A, Witt C, Dawe D, editors. Increasing productivity of intensive rice systems through site-specific nutrient management. Enfield, N.H. (USA) and Los Baños (Philippines): Science Publishers, Inc., and IRRI. p 29-58.

agricultural laborers account for 13% of the rural labor force. On Java, 45% of all rural households do not own any agricultural land. Besides working on farms, the rural landless catch fish or work in construction or public transport. Most juggle a combination of jobs to make ends meet.

Furthermore, these people are often anonymous, without any political voice even at the local level, much less nationally. Their plight is poorly understood for lack of research focused on them. One Bangladeshi laborer stated that the major difference that Green Revolution modern varieties made in his life was that farmers were now forced to extend the courtesy of calling him by name to ensure that he showed up when hired to collect the much larger harvest.

Even when landless laborers are paid in-kind for their work on rice farms, they do not receive enough rice to meet the needs of their family for the whole year. As a result, some spend 30-40% of their annual income just to buy rice — let alone meat, fish, dairy products or vegetables. A study by Steven Block of Tufts University

showed that higher rice prices in Indonesia during the Asian financial crisis of the late 1990s caused many poor families to cut spending on food other than rice, leading to a measurable fall in children's blood hemoglobin levels.¹

Spending on education or health care for their children is a luxury many rural poor cannot afford at all. This condemns one generation after another to a prison of poverty and debt reinforced by debilitating ignorance and ill health.

These rice consumers are the poorest of the poor in Asia, the continent that is home to most of the world's poor. For them, nothing can be more urgent than agricultural research to make their main source of calories — their biggest and least discretionary expense — more affordable. 🌾

¹Block SA. 2003. Nutrition knowledge, rice prices and the micronutritional effect of Indonesia's crisis of 1997-98. In: Mew TW, Brar DS, Peng S, Dawe D, Hardy B, editors. Rice science: Innovations and impact for livelihood. Proceedings of the International Rice Research Conference, 16-19 September 2002, Beijing, China. Beijing: International Rice Research Institute, Chinese Academy of Engineering, Chinese Academy of Agricultural Sciences. p 789-805.

System of rice intensification responds to 21st century needs

BY NORMAN UPHOFF

The system of rice intensification (SRI) was developed in Madagascar 20 years ago by Fr. Henri de Laulanié of the Society of Jesus after 2 decades of working with farmers to raise their rice production without depending on external inputs. Today, SRI is gaining acceptance around the world. Practiced only in Madagascar until 1999, it has since demonstrated its environmentally friendly benefits from China to Cuba and from the Philippines to Peru.

SRI is still controversial in some circles, despite our ability — given more space than is available here — to explain in scientific terms why younger and fewer seedlings transplanted with wider spacing and no continuous flooding, and nourished by compost rather than chemical fertilizer, give much higher yield than conventionally grown rice (see <http://ciifad.cornell.edu/sri>). By changing how plants, soil, water and nutrients are managed, SRI can achieve average yields about double the present world average of 3.8 t/ha. When the methods are applied well and so improve the soil, yields can reach 15-20 t/ha. SRI practices improve the growing environment of the plant so that any rice genotype can result in different, more-productive phenotypes having much larger root systems. The growth and health of the plants are supported by the greater abundance and diversity of soil biota.

With SRI, farmers do not need new rice varieties, because all cultivars respond positively. The best SRI yields have been achieved with high-yielding varieties or hybrids, but even traditional varieties can produce 6-8 t/ha — and as much as 10-12 t/ha. Since SRI reduces seed requirements by 80-90%, it slashes otherwise significant hybrid seed costs. Farmers do not need to use chemical fertilizer or other agrochemicals, as the highest yields come with compost made from any available biomass, and SRI-grown plants naturally resist pests and diseases.


The possibility of achieving higher yields with a 25-50% reduction in water requirements addresses a growing need to conserve water in this century. As SRI rice paddies are not continuously flooded, they may also reduce greenhouse gas emissions, though this cannot be assessed until SRI is used on a larger scale. Stronger root systems help the plants stand up to drought, wind damage and cold spells, and also make more feasible ratoon crops harvested from stubble regrowth.

Farmers who adopt SRI need information and training but no new capital expenditures. Once initial skepticism is overcome, SRI is easy to learn and disseminate. Anyone who knows how to grow rice and is motivated can easily learn the system. As farmers are encouraged to experiment with variations to the methods and thus to improve them, developing human resources is an intrinsic part of SRI extension.

SRI requires more investment in water management to allow farmers to apply smaller amounts only as needed. And it is initially more labor-intensive by 25-50%. However, once farmers have mastered the methods, SRI can even become labor-saving and applicable on a large scale. One commercial farmer in the Godavari Delta of the Indian state of Andhra Pradesh planted nearly 45 ha to SRI rice in the last *rabi* (dry) season.

Some suggest that SRI is a niche innovation, relevant only for certain conditions regarding soil or other factors. However, practically all of the recent 300 *kharif* (wet) season on-farm trials of SRI in Andhra Pradesh, distributed across the diverse soils of its 22 districts, were successful (excepting those on saline soils). In China, SRI yield increases have been documented from Zhejiang in the east to Sichuan in the west, and from Hainan in the tropical south to Heilongjiang in the far north.

SRI is spreading because it is versatile and can more than double farmers' net income (see an International Water Management Institute evaluation of SRI in Sri Lanka at www.iwmi.cgiar.org/pubs/rrindex.htm, Research Report No. 75). With respect to the agricultural and food-security needs of the new century, SRI is a "designer" innovation that efficiently uses scarce land, labor, capital and water resources, protects soil and groundwater from chemical pollution, and is more accessible to poor farmers than input-dependent technologies that require capital and logistical support.

We hope that many institutions and individuals will join in helping to improve the understanding and spread of this innovation, which can go far toward meeting this century's economic, social and environmental needs. 

Dr. Uphoff is director of the Cornell International Institute for Food, Agriculture and Development.

SRI efficiently uses scarce land, labor, capital and water resources, protects soil and groundwater from chemical pollution, and is accessible to poor farmers

Agronomic UFOs waste valuable scientific resources

BY THOMAS R. SINCLAIR

Discussion of the system of rice intensification (SRI) is unfortunate because it implies SRI merits serious consideration. SRI does not deserve such attention. A multinational team has shown from both theoretical evaluations and a number of experimental tests that SRI offers no yield advantage. Significantly, these results by Sheehy et al. were published in *Field Crops Research* (2004), an international journal that requires anonymous reviews. Their research used the classical scientific approach of assessing a concept's consistency with existing facts and knowledge, and conducting critical experimental investigations with appropriate controls and statistical tests.

Three components of the SRI strategy run directly counter to well-established principles for high crop growth. These principles were developed over many years of careful testing and scrutiny by scientists worldwide, and they have stood the test of time.

First, SRI uses very low plant densities. Energy for crop growth results from intercepted sunlight, and the amount of light intercepted translates directly into plant growth. High plant density enhances light interception, growth and yield. SRI suffers from poor light interception because of low plant densities.

Second, SRI replaces paddy flooding by simply maintaining "moist" soil conditions. The physiology and physics of plant water use have been researched for more than 300 years, and the relationship between growth and plant water use is unambiguous. Ample water maximizes rice yields, and flooded paddy fields assure that no water limitations develop.

Third, SRI emphasizes organic nutrient to the exclusion of mineral fertilizer. SRI faces a serious challenge in obtaining sufficient mineral nutrients from organic sources to achieve high yields. Rice grains contain about 0.013 grams of nitrogen per gram of seed (1.3% N). A claimed yield of 15 t/ha requires nitrogen from over 50 t/ha of organic matter. Such a monumental demand for organic matter creates huge challenges in sourcing, handling and managing these materials.

Further, the basis for SRI is explained with misinterpreted or fragmentary literature, which is used without a full understanding of the overall processes regulating and influencing plant growth and yield. Crop growth is fundamentally the accumulation of carbon and nitrogen and their partitioning to growing seeds. For example, one erroneous assumption is that shortening the phyllochron (leaf emergence rate) in itself

accelerates growth; no such direct link to growth exists.

Another example of misunderstanding is the claim that not flooding the soil overcomes the supposedly negative consequences of aerenchyma (air channels) in rice roots. Aerenchyma are naturally present in rice roots and form both when the roots are flooded and in SRI. Further, aerenchyma form in the root cortex and neither infringe on the vascular tissue nor negatively impact water or nutrient transport.

Regrettably, SRI appears to be only the latest in a family of unconfirmed field observations (UFOs) that have several features in common with their space UFO cousins. While there is an abundance of "sightings," they are anecdotal and reported by people who have minimum understanding of the basic scientific principles being challenged by such reports. In many cases, mysterious circumstances are invoked to explain the miraculous — for SRI, there are unexplained "synergies" and processes in the rhizosphere (the zone in which plant roots interact with soil microbial populations).

Egregiously, some people who have little or no research experience are able to influence the agricultural research agenda and cause UFO reports to be taken seriously. Such decisions require widely published scientists to produce documented responses, causing losses in time and resources that could otherwise be committed to investigating well-founded hypotheses for true understanding in maintaining and increasing crop productivity.

One lesson to be learned from the SRI experience is that there are no shortcuts to increasing crop yields. The history of crop yield increase tells of decades of hard-won scientific advances in understanding the biology, biochemistry and physics of plant growth and yield. Research requires intensive investigations by those trained to understand the theoretical context of their research and to undertake the critical experiments. Most importantly, results are not accepted until the research is described in an unbiased manner in a scientific journal that relies on anonymous reviews.

It is hoped that the SRI experience will infuse those making funding decisions for agricultural research with renewed skepticism and caution upon the next "sighting" of an agronomic UFO. 🍌

Dr. Sinclair is a plant physiologist in the U.S. Department of Agriculture's Agricultural Research Service.

One lesson to be learned from the SRI experience of unconfirmed field observations (UFOs) is that there are no shortcuts to increasing crop yields

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