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Rice Today

International Rice Research Institute October-December 2004, Vol. 3 No. 4

Official publication of International Year of Rice 2004

Rice year updates
Scientific article awards and Brazil full of beans

Summing up
Research with the giants of rice, China and India

Quality time
Improving the nutrition and palatability of rice

Reason to cheer
Thousands of farmers kick the pesticide habit

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IRRI

Rice Science for a Better World

Drought, floods and problem soils trap many rice growers in poverty, so making harvests more reliable means more money for farmers

Rice is Life

INTERNATIONAL YEAR OF RICE 2004

contents

RiceToday
Vol. 3, No. 4

TIM VARLOW (TERRACED RICE PADDIES, LUCENA, PHILIPPINES, 28.04.04)

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EMBRAPA

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Rice Today is published by the International Rice Research Institute (IRRI), the world's leading international rice research and training center. Based in the Philippines and with offices in 11 other countries, IRRI is an autonomous, nonprofit institution focused on improving the well-being of present and future generations of rice farmers and consumers, particularly those with low incomes, while preserving natural resources. IRRI is one of 15 centers funded through the Consultative Group on International Agricultural Research (CGIAR), an association of public and private donor agencies. For more information, visit the CGIAR Web site (www.cgiar.org).

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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 600 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.

Targeting human suffering and need

by Gary H. Toenniessen

The Rockefeller Foundation™

The Rockefeller Foundation focuses on achieving lasting improvements in the lives and livelihoods of poor people by working with them to ensure that they are included among the beneficiaries of globalization. To this end, the foundation provides grants in four main areas: helping to eradicate poverty and hunger, minimizing the burden of disease, improving employment opportunities and increasing the availability and quality of housing and schools in the U.S., and stimulating creativity and cultural expression.

Since the foundation's creation by American businessman and philanthropist John D. Rockefeller in 1913, we have emphasized the importance of generating new knowledge and harnessing existing knowledge to address the complex and difficult challenges confronting poor people. By using the tools of science, technology, research and analysis, we are able to aim our efforts at the very sources of human suffering and need.

Our work to achieve food security for poor people starts with the realization that, of the more than 5 billion people living in developing countries, nearly 1.3 billion live on less than US$1 a day. And, of these poorest of the world's poor, the majority live in rural areas, mostly on small farms where climate and soil conditions are harsh and variable, and where years of hard labor often yield barely enough for survival. For these families, the productivity of the farm and the success of any given year's harvest are the sole factors separating household food security from starvation.

The Rockefeller Foundation seeks to help small farmers in three ways: producing and distributing higher-yielding seeds; conserving and enriching soil for more productive, sustainable farming; and developing markets where small farmers can earn more from surplus harvests

ROCKEFELLER FOUNDATION

DR. TOENNIESSEN is the Rockefeller Foundation's director for food security.

The Rockefeller Foundation seeks to help small farmers in three ways: producing and distributing higher-yielding and more resilient seeds; conserving and enriching soil for more productive, sustainable farming; and developing markets where small farmers can earn more from surplus harvests.

Breeding better varieties of crops, whether by traditional cross-hybridization or cutting-edge biotechnology, has led to bigger and more reliable harvests — the essential first step in combating poverty and starvation. Soil conservation and enrichment programs increasingly involve farmers and community organizations as well as scientists in setting priorities and in spreading new practices to more and more farms. Some of our recent work in East Africa has focused on assembling the elementary components of produce markets, including a new network of community cereal banks where farmers aggregate their surplus, store it safely, and transport it in bulk to commercial centers for a competitive price.

As the staple food of billions, rice has always been an important focus of our work. The foundation is proud to have been one of the founders of the International Rice Research Institute (IRRI) in 1960. More recently, a nearly 2-decade effort by the foundation spanning much of the 1980s and 90s produced a community of rice biotechnology researchers that has created more prolific, robust and nutritious strains of this staple crop. And much of our current funding aims to improve rice, maize and other staples so that poor farmers can grow food on land endowed with less water, using less labor and fewer chemical inputs. IRRI, which continues to be an important grantee, has been a key partner in these efforts and many others.

Genetic resources treaty comes into force

ARIEL JAVELLANA

The International Treaty on Plant Genetic Resources for Food and Agriculture came into force on 29 June following ratification by 55 countries.

"The treaty establishes an internationally agreed framework that recognizes the rights of the farmers and countries that have developed ancestral crop varieties, and it implements an agreed mechanism for sharing the benefits arising from the exploitation of biodiversity," said N.R. Sackville Hamilton, head of IRRI's Genetic Resources Center (see Grain of Truth on page 42).

The Food and Agriculture Organization (FAO) of the United Nations, which developed the treaty, is optimistic about its success following qualified but widespread international support across a wide range of sectors, from the current U.S. administration to nongovernmental organizations.

Around 600,000 samples held in genebanks by the Consultative Group on International Agricultural Research (CGIAR) will be put under the realm of the treaty, protecting germplasm that has already averted multiple food crises caused by disease, pestilence and civil strife.

The treaty's provisions include the Multilateral System for Access and Benefit Sharing, which is designed to ensure easy access and exchange of plant genetic resources, and the fair and equitable sharing of benefits incurred. The system includes 35 food crops and 29 forage crops of global importance and covers information exchange, technology access and transfer, and capacity building.

The treaty's Global Crop Diversity Trust, set up by FAO and the International Plant Genetic Resources Institute on behalf of the CGIAR centers, will establish an endowment fund to support genebank conservation and capacity building for developing countries. Approximately US$45 million of the $260 million target has already been pledged.

"The treaty brings countries, farmers and plant breeders together and offers a multilateral approach for accessing genetic resources and sharing their benefits," said FAO Director General Jacques Diouf. "Humankind needs to safeguard and further develop the precious crop gene pool that is essential for agriculture. The agreement recognizes that farmers around the world, particularly those in the South, have developed and conserved plant genetic resources over the millennia. It is now up to countries to make the treaty fully operative."

See also *Joint Account with Interest* on pages 22-25.

- The urgent need for a workable treaty on plant genetic resources can be seen in the case of a gene known as *Xa21*. Found in the African wild rice species *Oryza longistaminata*, *Xa21* offers resistance to bacterial blight. Research by public and private organizations — including IRRI, Monsanto, Pioneer and the University of California, Davis — has been continuing since a sample of *O. longistaminata* was brought from Mali to IRRI in the mid-1970s. Eight years ago, UC Davis set up a Genetic Resources Recognition Fund to ensure that some of the benefits and profits from the discovery flowed back to the plant's traditional owners. But legal wrangling and the dropping of *Xa21* from private companies' research agendas have meant that the people of Mali have yet to receive any benefits at all. Read about it in the *Sacramento Bee* (www.sacbee.com/static/live/news/projects/biotech/c1_1.html).

Briefly Briefly Briefly

Rice tomorrow

This is the last of four special issues of *Rice Today* for the International Year of Rice. The publishing schedule for 2005 is under consideration.

Rice in Scotland

Mike Jackson, IRRI director for program planning and coordination, spoke on 2 June in Edinburgh, Scotland, following an invitation from the Cross Party International Development Group of the Scottish Parliament. His address, *Achieving the UN Millennium Development Goals begins with rice research*, was attended by members of the Scottish Parliament as well as representatives from Scottish business and academic groups and nongovernmental organizations.

Iron-rich rice in Thailand

Researchers from the Rice Research Institute of Thailand's Department of Agriculture have discovered two strains of iron-rich rice that could be developed to fight anemia among the poor. More than a quarter of the country's population is anemic. The institute plans to continue its search for iron-rich strains, use genetic engineering to further boost iron content, and determine the best growing and milling techniques to preserve iron in the rice.

French ties

Senior officials and scientists of France's Agricultural Research Center for International Development and Institut de Recherche pour le Développement met with IRRI representatives in Bangkok, Thailand, on 25-26 May to review and improve current collaboration and identify new opportunities. Participants called for further collaboration on several projects including the Challenge Program on Water and Food, the Consortium for Unfavorable Rice Environments and initiatives for Africa. The French institutes agreed to help train IRRI staff — particularly talented nationally recruited staff — in France, while IRRI will help train young French scientists. The next meeting was set for 2006 in France.

China and Nepal online

China and Nepal are the latest countries to join IRRI's Rice Knowledge Bank (www.knowledgebank.irri.org), the online repository of rice know-how. The bank's country sites offer country-specific information and materials in local languages. Bangladesh has also launched its own site, which will be mirrored on IRRI's Rice Knowledge Bank server.

Hands-on in Vietnam and India

IRRI recently held its CD-based integrated pest management training courses for research and extension personnel in Vietnam and India. Based on information in

Bangladesh poverty project winds up


AILEEN DEL ROSARIO-RONDILLA

The project Poverty Elimination Through Rice Research Assistance (PETRRA) wound up after 5 years with a closing dialogue on "Agricultural technology and innovations for the poor" in Dhaka on 13 July. PETRRA was managed by IRRI in collaboration with the Bangladesh Rice Research Institute (BRRI) and funded to the tune of £9.5 million (US$17 million) by the United Kingdom's Department for International Development.

The dialogue focused on sustaining the project's innovations. Earlier, IRRI Representative and PETRRA Project Manager Noel Magor spoke on *PETRRA technologies, extension, innovations and impact* and IRRI Social Sciences Division Head Mahabub Hossain presented *PETRRA approach and policy overview*.

In its 5 years, PETRRA has engaged over 700 scientists and development professionals working with 47 local and international development organizations to implement 45 sustainable rice-based poverty reduction subprojects, which have helped over 11,000 farmers in more than 500 villages across the country. More than 40% of the participants were women.

PETRRA broke new ground for a large-scale development project by calling on organizations to make competitive bids for the control of subprojects, which ensured the most suitable researchers for the job. The structure also drew together three important strands that are normally considered separately — technology identification and development, identification of improved uptake methods and pathways, and stimulation of policy dialogue for a pro-poor policy environment.

Association of Southeast Asian Nations agrees to formal relationship with rice institute

The Association of Southeast Asian Nations (ASEAN) will establish formal relations with IRRI, bringing together the largest grouping of rice-producing nations and the world's leading rice research institute.

ASEAN senior officials for agriculture and forestry agreed to the new ties at a meeting in Kuching, Malaysia, on 11-13 August, following an approach from IRRI in 2003. A letter from ASEAN Secretary General Ong Keng Yong informing IRRI Director General Ronald P. Cantrell of the decision arrived on 1 September, as *Rice Today* was going to press.

"We look forward to collaboration with ASEAN and its members and related organizations such as ASEAN Plus Three," said Dr. Cantrell, referring to ASEAN's link with China, Japan and South Korea. "Obviously, IRRI already enjoys strong links with a number of ASEAN member nations, but this new status for the institute will build on and strengthen these relationships."

Dr. Cantrell added that IRRI is especially interested in working with ASEAN in three particular areas: water, global warming and human resources. "These problems are shared by ASEAN members, so common solutions make a lot of sense," he said.

The decision follows a decade of waning support from the developed Western countries that are IRRI's traditional donors. The institute's funding plunged from US$45 million in 1993 to $26 million in 2003, as many donors focused on other needs, such as assistance for Africa.

Briefly

IRRI's Rice Knowledge Bank, this type of training allows the institute to reach more participants with fewer resources. Participants received hands-on experience in calculating yield losses caused by pest attack and discussed recent pest problems in their respective countries. They also talked with farmers about their knowledge of pests and their existing management practices.

Filipino friends

Philippines-based IRRI has coordinated with the *Komisyon sa Wikang Filipino* (Commission on the Filipino Language) to have five brochures translated into Filipino.

Direct approach

The Bangladesh Rice Research Institute held a "Review and planning workshop on direct-seeded rice using the drum seeder" in Dhaka on 19-20 June. Participants identified and discussed future needs for research and development, strengthened partnership among stakeholders, and learned from farmers and researchers about the successes, strengths and weaknesses of direct-seeding technology.

Wild project launched

An initiative to boost the conservation and use of the wild living relatives of some of the world's key crops was launched on 28 June in Colombo, Sri Lanka. Bringing together the biologically rich countries of Armenia, Bolivia, Madagascar, Sri Lanka and Uzbekistan, "*In situ* conservation of crop wild relatives through enhanced management and field application" aims to improve key features of traditional crops, from their economic and nutritional value to their ability to fight disease. Funded by the Global Environment Facility, project partners include the International Plant Genetic Resources Institute and the United Nations Environment Program.

Blasting blast

The U.S. Department of Agriculture's Agricultural Research Service (ARS) is exploring a promising new approach to control the devastating rice blast fungus, *Magnaporthe grisea*, which causes rice yield losses of up to 30% each year worldwide. ARS researchers are studying key genes from both the pathogen and a resistant rice cultivar to determine how resistant plants defend themselves from a blast attack. As rice plants and their blast pathogens have evolved together, plants that possess a resistance gene that matches a related counter-resistance gene in the fungus will launch a strong defense. The ARS aims to develop rice plants with such resistance genes.

Poverty on the map

IRRI's Social Sciences Division and the Bangladesh Center for Policy Dialogue held a discussion on rural poverty alleviation on 26 May in Dhaka. More than 100

Information technology to boost rice production

The Asian Development Bank (ADB) approved in July a US$1 million grant to help improve food security and livelihoods for poor farmers in the Greater Mekong Subregion using information and communications technology (ICT) with help from IRRI's Rice Knowledge Bank.

The grant, from the Japan Fund for Information and Communications Technology, will help boost rice production in Cambodia, Thailand and Vietnam by providing better access to information on market prices and improved production techniques and global practices. Rice Knowledge Bank material will be adapted to meet the needs of local farmers. The bank will also serve local agricultural extension workers, information facilitators, nongovernmental organizations and other institutions.

"ICT offers powerful new ways to capture, present and disseminate the wealth of knowledge available," said C.R. Rajendran, director of the Agriculture, Environment and Natural Resources Division of ADB's Mekong Department. "However, most poor and small-scale farmers are unable to access such information available through ICT due to language barriers, lack of tools and lack of knowledge about existing information. Also, they may be overwhelmed and intimidated by ICT."

Agricultural extension workers and organizations that work with and support poor farmers often have limited knowledge of global practices and little experience in applying ICT-based information at the local level. "These countries need to build and strengthen agricultural information networks to manage and apply information to benefit farmers," said Rajendran.

The grant complements the Japan Fund for Poverty Reduction grant for Improving Poor Farmers' Livelihoods through Postharvest Technology approved earlier this year (see *Rice Today* Vol. 3, No. 3, page 8).

PPRI

PYONGYANG POWWOW: Posing in front of the Plant Protection Research Institute (PPRI) of the Academy of Agricultural Sciences in the capital of the Democratic People's Republic of (North) Korea are (*from left*) an unidentified PPRI scientist; Zhao Kaijun, IRRI liaison scientist for China; an unidentified scientist; Jojo Lapitan, senior manager in IRRI's International Programs Management Office; Ren Wang, IRRI deputy director general for research; Ri Je-Ok, PPRI deputy director; an unidentified scientist; K.K. Jena, senior scientist in IRRI's Plant Breeding, Genetics and Biochemistry Division and IRRI representative to the Republic of (South) Korea; and Jon Dong-Gon, officer in the Department of International Science and Technical Exchange of the North Korean Academy of Agricultural Sciences (AAS). The AAS invited IRRI scientists to help assess the country's rice research-and-development needs and explore opportunities for cooperation at a 20-24 July meeting, where they identified as priority areas hybrid rice research and breeding for high-yielding varieties with low water and nitrogen inputs. A follow-up meeting was agreed for 2005.

Briefly

people attended the event, which featured a presentation by Division Head Mahabub Hossain on IRRI's collaborative study with three Bangladeshi institutions on mapping rural poverty to identify poverty hotspots and the socioeconomic and biophysical factors behind them (see *Pinning Down Rural Poverty* in *Rice Today* Vol. 3, No. 3, pages 30-31). Chief guest Mushfiqur Rahman, chairman of the Parliamentary Standing Committee of the Finance Ministry, said he would take the findings of the study to the finance minister and expressed the need for better-managed anti-poverty programs.

Extending technology

The Department of Agriculture of Sri Lanka and IRRI conducted a joint training workshop on technology promotion and delivery using cyber extension on 28 June-2 July in Peradeniya, Sri Lanka. The training course marked the beginning of the collaborative project "Improving productivity of the Sri Lankan rice granary through effective technology promotion and delivery systems using information and communication technology." Participants learned how to best use information technology to aid agricultural extension.

Dry discussions

About 140 scientists from Asia, Africa and Latin America met in Mexico on 24-28 May to present their research on drought tolerance in plants and discuss ways forward. The meeting, supported by the Rockefeller Foundation and the International Maize and Wheat Improvement Center, looked mainly at maize, rice and wheat, which account for more than half the calories consumed by people in the developing world.

Unfavorable advances

The Consortium for Unfavorable Rice Environments (CURE) conducted its third annual steering committee meeting on 2-4 June in Ubon Ratchathani, Thailand. The committee elected Thailand's Suthep Limthongkul as its next chairman and endorsed the appointment of IRRI Social Sciences Division Head Mahabub Hossain as the new CURE coordinator, replacing Tom Mew, who has retired. Indonesia will host the next steering committee meeting in June 2005. A seminar on "Sustainable rice-based production systems in fragile rice environments" and a workshop on "Innovative research methods and strategies" were held concurrently with the meeting.

Rice reunion

The IRRI reunion on 25-27 June attracted about 100 former IRRI staff and family members to Michigan State University. Attendees included former IRRI plant pathologist Mike Bonman and retiring IRRI Principal Scientist Tom Mew, as well as two founding staff members, Lloyd Johnson and Carolyn Moomaw Wilhelm. Rice breeder Hank Beachell, the 1996 World Food Prize laureate who turned 98 years old in September, participated via speakerphone.

Global warming has unexpectedly large effect on rice yield

Everybody has been talking about the weather lately. ABC, BBC, CBS, CNN, VOA, AP and Reuters were among the broadcasters and global news organizations covering it at length. The *Miami Herald*, *Washington Post*, *Philippine Daily Inquirer*, *Philippine Star* and *Hindustan Times* were among the newspapers that carried the item.

The reason? New research demonstrates that, as AP put it, "Global warming could mean bad news for one of the world's most important crops, rice."

Field studies conducted at IRRI confirmed predictions from theoretical studies that global warming will make rice crops less productive. Combining a quarter century of climate data collected at IRRI with yield trends in adjacent fields over the past dozen years, researchers further discovered that simulation models underestimated the problem by half because they overlooked the pernicious effect of higher minimum nighttime temperatures.

The study, reported in the 6 July issue of *PNAS*, the proceedings of the National Academy of Sciences of the United States of America, found that rice yields at IRRI declined by 15% for every 1°C increase in mean daily temperature. Temperatures are projected to rise globally by 1.5-4.5°C in the coming century — or 3 to 9 times more than in the past century. Global warming thus threatens to erase the hard-won productivity gains that have kept the rice harvest growing in step with population.

The study recorded that the mean minimum nighttime temperature during the dry season at IRRI has risen since 1979 by 1.13°C, or 3 times the 0.35°C rise in mean maximum daytime temperature. This difference is an expected consequence of increased greenhouse gas concentrations in the atmosphere, and IRRI's climate records are consistent with warming trends found elsewhere in the Philippines and globally.

The news is that high nighttime minimum temperatures clearly and strongly suppressed rice yields in the seasons in which they occurred, while high daytime temperatures had no measurable effect.

"Most studies of temperature and global warming effects on crop growth and grain yield are based on daily mean air temperature, which assumes no difference in the influence of day versus night temperature," wrote the nine-member research team from IRRI, China and the United States led by IRRI crop physiologist Shaobing Peng. "This report provides direct evidence of decreased rice yields from increased night temperature associated with global warming."

Theoretical models had predicted a 7% decline in rice yields for every 1°C increase in daily mean air temperature. However, yields in the experimental fields actually fell by 10% for every 1°C increase in seasonal mean minimum temperature. Because the increase in night temperature was 3 times greater than the increase in daytime temperature, rice yields declined by 15% for every 1°C increase in daily mean temperature — double the predicted 7% decline.

***LOVE IN A TIME OF PESTICIDES** for Asian rice farmers* was the headline of the 15 July issue of *Nature* report on radio soap operas being developed in Vietnam and Laos by IRRI and local partners. The shows, it said, "merge tips on the frugal use of pesticides with drama based on everyday tales of farming folk" — not unlike *The Archers*, a U.K. program with a similar agricultural mandate. "Our research shows that 80% of pesticides are spread at the wrong time for the wrong insect," *Nature* quoted K.L. Heong, the IRRI entomologist who initiated the project, as saying. A US$300,000 grant from the Rockefeller Foundation (*see page 5*) will support the development of two programs per week for a year.

Continuing food imports worry Chinese leaders who lived through famine in the 1960s

China's surging food imports have received broad coverage both in China and globally. In the 23 August *Financial Times* newspaper, James Kynge reported that China's becoming "a net importer of farm produce [is] raising concerns at the highest levels of government about the security of the food supply for 1.3 billion people as land and water shortages put pressure on domestic grain production."

China's imports of farm produce in the first half of 2004 rose 62.5% over the same period of 2003. "The biggest changes were seen in grain imports as strategic stocks fell because of declining annual harvests every year since 1998," Kynge wrote, adding that Chen Xiwen, a senior state council official, said recently that China's grain production-consumption deficit this year would be about 37.5 million tons.

"The leadership is very concerned about food security," reportedly said an academic who advised the government on food security issues. "They were all young men during the famine of the late 1950s and 1960s. It is not only a strategic issue of dependence on foreign markets for them, it is also a very personal issue of food self-sufficiency."

AFP, the French news agency, reported on 19 July, citing Chen, that "China's production of wheat, corn, rice and other food grains dipped from a record high of 512 million tons in 1998 to some 435 million [by another account 431 million] tons in 2003." Last year's deficit of 55 million tons prompted, the report said, "a dramatic rise in imports ... resulting in across-the-board grain price rises on international markets."

The report added, "Chinese Premier Wen Jiabao this month said that developing agriculture was a major priority for the government and reiterated plans to strengthen China's grain-production capacity by urging local governments to subsidize producers."

On the same day as the AFP report, the *China Daily* ran two prominent stories on China's grain deficit. A report on the front page noted that the rice harvest will likely recover this year thanks to a 533,000 ha expansion of planted area over 2003.

"We can meet the target of producing 455 million tons of grain this year, but we have no reason to feel relaxed because a deficit remains," Chen reportedly said at the 17 July opening ceremony of the China Food Security Research Center, a national food security think tank in Beijing.

"At the beginning of this year, the government decided to spend a record 150 billion yuan (US$18 billion) to encourage farmers to increase grain production, to improve rural infrastructure and to ensure the country's food security this year," the report added.

A longer feature on page 5 (www.chinadaily.com.cn/english/doc/2004-07/19/content_349485.htm) reviewed the history of grain production in China, looked forward for the next 3 decades, and

continued on page 10

Digesting nutrition in rice

The Food and Agriculture Organization (FAO) of the United Nations released in June a paper entitled *Nutritional contribution of rice and impact of biotechnology and biodiversity in rice-consuming countries*.

"Rice is the predominant staple food in at least 33 developing countries, providing 27% of dietary energy supply, 20% of dietary protein and 3% of dietary fat," begins the paper, adding that, in such rice-dependent countries as Bangladesh, Laos, Vietnam, Myanmar and Cambodia, rice supplies more than half of the dietary energy and protein and 17-27% of dietary fat. "Rice can contribute nutritionally significant amounts of thiamine, riboflavin, niacin and zinc to the diet, but smaller amounts of other micronutrients."

Looking into research to raise the content of iron in rice is a report in the May-June issue of *ADB Review*, published by the Asian Development Bank. "Iron deficiency is the most common of all nutritional deficiencies," writes health specialist Lisa Studdert, who then describes ADB-supported research, notably a feeding trial of more than 300 religious sisters in the Philippines. "The trial concluded in September 2003 and, so far, the analysis of data indicates that the results have been positive."

The complete FAO report is available in HTML format at www.fao.org/DOCREP/006/Y4751E/y4751e05.htm#bm05. The *ADB Review* article is available at www.adb.org/Documents/Periodicals/ADB_Review/2004/vol36_3/rice_power.asp.

Agriculture ministers adopt joint initiative in Beijing

The Chinese news service Xinhua (www.chinaview.cn) reported on 23 May that a 2-day Asia Cooperation Dialogue (ACD) workshop in Beijing had attracted agriculture ministers or vice ministers from 20 countries. Participants agreed to cooperate in the areas of development policy, practical technology, sustainable development, and rural development and poverty alleviation.

Chinese Vice Minister of Agriculture Zhang Baowen reportedly promised that China will organize two follow-up activities: an ACD agricultural policy forum to discuss development strategy and policy measures and, to mark International Year of Rice, a rice-development workshop and technology exhibition.

Xinhua also covered, on 17 May, a report from the Food and Agriculture Organization (FAO) of the United Nations declaring that rice plays and will continue to play "a crucial role in the sustainable agricultural development of the Asia-Pacific region." The release of the report coincided with FAO's annual Regional Conference for Asia and the Pacific, held in Beijing on 17-21 May.

The report was not optimistic, however, about the future of the international rice trade, which it projected to increase at a modest 1.5 % per year in the current decade to 29.3 million tons in 2010, much below the explosive growth of the 1990s.

Xinhua said the report called for radical changes in rice-trade policy.

- For an in-depth look at the question "Where will demographics take the Asia-Pacific food system?" in *Amber Waves*, which is published monthly by the Economic Research Service of the U.S. Department of Agriculture, log on to www.ers.usda.gov/amberwaves/june04/features/WhereWillDemographics.htm.

Philippine government set to ramp up hybrids

The *Manila Bulletin* reported on 13 June that the Philippine government is determined to plant more hybrid rice within the next 6 years to improve food security and livelihoods for its growing population.

"Our ability to produce more rice translates to more livelihood opportunities and, ultimately, to an adequately fed population — key elements in the eradication of poverty and the attainment of economic development and lasting peace," reportedly said Luis Lorenzo, Jr., then agriculture secretary.

He was speaking at a seminar on Rice and the Filipinos: The Last 100 Years, held at the Bureau of Plant Industry in the Quezon City capital district of Metro Manila. The seminar was the first in a series of eight seminars jointly organized for International Year of Rice by the Philippine Rice Research Institute, Philippine Institute for Development Studies, and several other research and educational institutions.

The paper reported that the 130,000 ha already planted to hybrid rice in the Philippines could expand to 1 million ha in 2005.

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considered how the country, quoting an old Chinese saying, can "repair the house before it rains."

An earlier report, released on 8 June by Bloomberg News, pointed out that China's woes are a boon to Thailand, which more than tripled its rice exports to China in the first 4 months of 2004, raising rice export earnings by 41% to $680 million.

Citing IRRI economist David Dawe, the report said that China has imported more rice than it exported only 3 times in the past 44 years: "China's future need for rice is 'the million-dollar question,' Dawe said. 'It affects everybody who's importing and exporting rice around the world. [...] The effects of even small price fluctuations on the welfare of producers and consumers, especially on the poor, can have political repercussions.'"

Dr. Dawe reportedly added that China's current grain shortfall mirrors an earlier one in 1995-96, as "rapid economic growth is leading to more jobs outside agriculture and, thus, labor shortages in agriculture." He further predicted that China will "manage this in a way that doesn't disrupt prices too much."

One approach the Chinese are taking, according to an article published in June by *Nature*, is to increase government funding for research and field trials of rice genetically modified for stress resistance. Funding of GM rice programs stands at $120 million, or 10% of China's total biotech budget ($1.2 billion for 2001-05, a 4-fold increase over 1996-2000), said the report, adding that the budget for field trials at the China National Rice Research Institute in Hangzhou enjoyed a 50% boost this year.

Another approach is to acquire farmland abroad. The Chinese news agency Xinhua announced on 24 May that the Chongqing Municipal government had inked a deal in March with Laos "to cooperatively build a comprehensive agricultural park in Laos for Chinese enterprises to produce grain." The $4.98 million, 5,000 ha agricultural park will include farmland, fisheries and farm-produce processing.

"The project is not the first of its kind in China," the report said. In 1996, a company in northwest China's Xinjiang Autonomous Region invested $50,000 to develop 150 ha in Cuba for growing rice, where a yield of 4.8 t/ha set a record for the Caribbean island. In 1998, the Xinjiang firm bought 1,050 ha of rice land from the government of Mexico for $3.2 million and achieved, after four harvests, a yield of 5 t/ha, or 1.5 t/ha above the Mexican average.

The day after the Xinhua report, the private intelligence firm Stratfor (www.stratfor.com) reported, "The announcement of the Laotian deal follows a similar plan for 3,000 Chinese laborers to move to Kazakhstan to work 700 square kilometers to grow soybeans and wheat and breed animals."

India renews focus on agriculture

This was the headline the *International Herald Tribune* gave in its 12 July edition to a Bloomberg News story by Subramaniam Sharma. Sharma reported that New Delhi's "plans to increase spending on irrigation facilities in rural areas and increase loans to farmers will spur growth and bolster demand for manufactured products, according to company executives and investors."

In his budget speech on 8 July, Finance Minister P. Chidambaram earmarked 28 billion rupees, or US$611 million, for irrigation projects and 26.1 billion rupees for rural water-supply plans in the year ending on 31 March 2005. Another 22.47 billion rupees has been set aside for rural housing, and Chidambaram repeated the government's intention to double agricultural credit in 3 years.

"About 58% of India's more than 1 billion people depend on agriculture for a living," said the report. "With agriculture accounting for a fourth of the economy, improving irrigation in a country that relies largely on rain for watering crops will help raise yields and farm incomes" with knock-on benefits for the rest of the economy.

However, Ashok B. Sharma, writing in the 12 July *Financial Express* (www.financialexpress.com), complained about gaps in the proposals, particularly regarding farm credit and agricultural research. "Sadly, there is no increase in the allocation for agriculture research and education," he wrote.

Sharma reported that the Indian Council of Agricultural Research has long demanded that the 5-year plan allocation to agricultural research be at least 1% of agriculture GDP, or 113 billion rupees. Meeting that goal in the current 5-year plan would require an additional allocation of 88.2 billion rupees in the remaining 2 years.

Sharma had earlier, on 2 June, mooted the appointment of M.S. Swaminathan, 1987 World Food Prize laureate (see *World Food Reprise* in *Rice Today*, Vol. 3, No. 3, pages 12-17) and former director general of IRRI (1982-88), as chairman of the newly constituted National Commission on Farmers. He quoted Krishan Bir Choudhary, chairman of the Indian farmers' organization Bharat Krishak Samaj, as saying that "the panel is intended for the farmers. The chairman of this body should be a farmer and not a bureaucrat or a technocrat or a scientist."

Dr. Swaminathan was just then delivering to the agriculture minister the report of a biotechnology task force he headed, which recommended setting up a regulatory authority to generate public confidence. Reuters quoted the report as saying: "The bottom line of our national agricultural biotechnology policy should be the economic well-being of farm families, food and health security of the nation, health security of the consumer, protection of the environment, and security of our national and international trade in farm commodities."

As chairman of the commission, Dr. Swaminathan has initiated study of a recent rash of farmer suicides. "There are incidents of farmers' suicides in parts of Andhra Pradesh, Karnataka and Kerala," he was quoted as saying in late August by the Sun Network (www.sunnetwork.org). "There are also severe malnutrition cases among farmers in some areas of Maharashtra and Orissa. It was decided to study in depth the role of technology and public policy in mitigating such suffering."

Dr. Swaminathan was speaking at a 2-day seminar on Medicinal and Aromatic Rice of Kerala organized by the Kerala Agricultural Research Station, Pattambi, in connection with the celebrations of International Year of Rice.

In another context, the *Wall Street Journal* quoted Dr. Swaminathan in its 25 June edition under the headline *An Indian Paradox: Bumper Harvests and Rising Hunger*. "Increasing food production is great, but we have to think about the whole chain," he reportedly said, explaining his foundation's advice to a struggling farmer that he should drive a taxi to help overcome the "famine of jobs and livelihoods" that afflicts India today.

"It is virtually impossible to simply hand out food surpluses to the hungry, despite the fact that undernourishment causes thousands of deaths a day, because of the cost and complexity of distribution," wrote journalists Roger Thurow and Jay Solomon. "It would also turn recipients into permanent wards of the world. 'I believe in Gandhi's strategy: Don't turn people into beggars,' says Dr. Swaminathan.'"

MANDY NAVASERO

***MOVERS AND SHAKERS:** Keepers of the Secrets of Rice* was the headline for Linda Bolido's profile of Flora de Guzman (*left*), manager of the International Rice Genebank at IRRI, and Thelma Paris, gender specialist in the institute's Social Sciences Division. The article appeared in the 29 August edition of the *Philippine Inquirer* (http://news.inq7.net/sunday/index.php?index=1&story_id=7567). "For the longest time, the only way women were ever associated with rice was when they were cooking and serving it," lamented Bolido, adding that these "two women scientists are fast revising that image through their work on rice research."

ALSO...

The prolific and opinionated *Financial Express* special correspondent **Ashok B. Sharma**, who in August received the first-ever Prem Bhatia Memorial Award for reporting on environmental and social affairs, wrote in June about "some healthy developments in the global agricultural research system," in particular "a good flow of funds from the member countries to the Consultative Group on International Agricultural Research (**CGIAR**)." At the end of the article (www.financialexpress.com/fe_full_story.php?content_id=60811) he concluded, "It is high time that India, which is a beneficiary of the CGIAR system, adequately increase its contribution."

- Karen von Hahn asked, in the 5 June edition of the *Globe and Mail*, "**Is rice the new fine wine?**" She added that the "humble grain ... appears poised to take center stage as the next peasant food to get the gourmet treatment" in the newspaper's home market of Toronto, Manhattan and beyond. "Even a decade ago, people's rice palates weren't particularly sophisticated," reportedly said Caryl Levine, founder of Lotus Foods, a California-based rice importer. "Now, rice is the next pasta. It's becoming the center of the plate." Feast on it at www.theglobeandmail.com/servlet/ArticleNews/TPStory/LAC/20040605/NOTICED05/TPEntertainment/Style.
- Rice was the cover story of the 16-22 July edition (Vol. 24, No. 2) of **nepalnews.com** (www.nepalnews.com.np/contents/englishweekly/spotlight/2004/jul/jul16/coverstory.htm). Keshab Poudel explains how weather, negligence and market conditions threaten the Himalayan kingdom's rice biodiversity. Poudel also interviews the Nepali agricultural scientist Dhruba Narayan Manandhar, and headlines the sidebar with the quote, "Nepal can claim to be a country of origin of rice." Finally, Sanjaya Dhakal details recent challenges both drought and heavy rains have brought farmers.
- Several stories by Mike Lee in the *Sacramento Bee* in July and August traced the brewing of a November **ballot-box brawl over agriculture** in California. Four consumer and environmental groups sought to ban biotech crops. A particular target was rice developed by Sacramento-based Ventria Bioscience that produces two common human proteins expected to be used to treat severe dehydration. Rice industry leaders reportedly feared that the initiative, if passed in Butte County, would impede advances at the agricultural research station at Biggs, which develops 90% of California's rice.
- *Asia-Pacific Perspectives: Japan Plus*, published in Tokyo by Jiji Gaho Sha with support from the Cabinet Office of the Japanese government (www.jijigaho.or.jp/index01.html), ran in its June 2004 edition (Vol. 2, No. 2) a 5-page profile of **Keijiro Otsuka**, chair of the IRRI Board of Trustees.

Reason to cheer

by Adam Barclay, photography by Aileen del Rosario-Rondilla

Thousands of Bangladeshi rice farmers kick the pesticide habit after proving to themselves that doing so saves money and safeguards their health and the environment

An American leads 3,000 Bangladeshi farmers in a rising Thai victory chant: "*Chai yo! Chai YO! CHAI YO!*" The scene is rousing, if odd, and the cheer is appropriate because these farmers in the district of Comilla, 80 km southeast of the capital, Dhaka, have won an extraordinary victory.

They are the vanguard of what could become one of the most beneficial rural movements in modern Bangladeshi history. If the Livelihood Improvement Through Ecology (LITE) project, led by the International Rice Research Institute (IRRI), continues as it has started, in less than a decade, most of Bangladesh's 11.8 million rice farmers — almost a 12th of the country's population of 141 million, according to the Bangladesh Rice Research Institute (BRRI) — will have stopped using insecticides and optimized their fertilizer use, thereby increasing their income by an average of US$17 per year. That may not sound like much to some, but where the average annual farm income after expenses is around $100, this money helps put children through school or buy grain to tide rice-deficit farm families over to the next harvest.

LITE — part of the IRRI-led project Poverty Elimination Through Rice Research Assistance, funded for Bangladesh by the United Kingdom's Department for International

A GROUP OF RICE FARMERS, led by rural development expert Jan Orsini (*hidden*), raises an incongruous but rousing Thai victory chant in Comilla, Bangladesh. Orsini (*inset*) enthuses from the podium of the previous day's workshop for 3,000 farmers about the success of the Livelihood Improvement Through Ecology (LITE) project.

Development — set out to discover the exact cause of an expected drop in rice yield when farmers stop spraying insecticide. The original aim, explains LITE principal investigator and IRRI senior entomologist Gary C. Jahn, was to identify safe alternatives to insecticides.

"To my surprise," reports Dr. Jahn, "when people stopped spraying, yields didn't drop — and this was across 600 fields in two different districts over four seasons. I'm convinced that the vast majority of insecticides that rice farmers use are a complete waste of time and money. If they don't spray they lose nothing, but they gain a lot — money, a safer environment and reduced risk to their health."

LITE farmers also learn to reduce and optimize their application of nitrogen fertilizer (urea). They do this by comparing the four panels of the leaf color chart (LCC) to the leaves of their rice crop, and then fertilizing the crop just enough for the leaves to match the ideal color (see *Chart Hit for N Sync* on page 33). The practice allows farmers to spend less on fertilizer and so improves their efficiency and profitability. What's more, in the 2004 dry season, farmers following the LITE strategy increased their yields by an average of 400 kg per hectare — a significant boost for struggling farm families.

The method used to expand the scale of LITE from a few hundred farmers to several thousand — and potentially millions — is known as success case replication (SCR). Lead farmers, identified as being more successful than their neighbors, are trained to use the LCC and perform the experiments that prove they don't need insecticides. They then train other farmers in their own village, as well as successful farmers from surrounding villages, who become the next lead farmers. The new lead farmers do the same, and the process repeats. The number of trained farmers grows exponentially each rice season — like recipients of a chain letter, but this time good things actually happen.

Success stories

The strategy can help improve the way people manage an enormous range of enterprises, not just farming. Jan Orsini, an IRRI consultant to LITE and a former United Nations rural development officer, is the SCR expert who led the Thai victory chant (he lives with his Thai wife in Bangkok). Orsini brims with passion when he discusses SCR's ability to improve people's lives, describing

LITE PRINCIPAL INVESTIGATOR Gary C. Jahn (*below*) at a workshop for 1,500 farmers in Rangpur. LITE farmer Kamrul Hasan and his wife Jannatol Ferdous (*top*) use their savings to buy better food and clothes for their children. Thousands of women (*opposite bottom*) — most of them wives of LITE farmers — attend the farmer workshop in Comilla. While few women in Bangladesh tend rice fields, they often play an integral role in decision-making and help with crop management. Many farmers supplement their income by pedaling a rickshaw (*opposite top*), seen here passing a rice field in Comilla.

success stories ranging from farmer cooperatives in the Philippines to guitar manufacturing in Vietnam.

A major advantage of SCR is its cost effectiveness, eliminating the need for large numbers of paid staff or expensive equipment and infrastructure. "You don't need a training center," explains Orsini. "All the training is hands-on. There's no theoretical training at all. It doesn't matter if the successful person can't read or write. All he has to do is explain and show others how to do it."

With an average of more than 1,000 people per square kilometer — compared with 30 in the United States and 250 in the Philippines — Bangladesh is more crowded than Australia would be with every living human squeezed into it. Historically, Bangladesh was relatively prosperous, but political instability, war and overpopulation have reduced it in modern times to one of the world's poorest countries.

Rice farming is a tough life, and subsistence is as good as many Bangladeshis can hope for. So when the government began doling out free insecticides to rice farmers in 1956, spraying rapidly gained a firm foothold. Subsidies continued — 100% until 1974, then 50% — and the government conducted campaigns encouraging farmers to spray. Indiscriminant insecticide use became so entrenched that the end of government handouts in 1978 saw farmers simply shoulder the whole cost.

ADAM BARCLAY

Natural enemies

Why doesn't spraying help yield? First, many supposed insect pests don't attack the parts of the plant that affect grain production, or the grain itself, under farm conditions — and so aren't pests at all. Second, many farmers use poor equipment to apply out-of-date or inappropriate insecticides at the wrong time. And third, insecticides can kill the natural enemies of rice pests more effectively than the pests themselves, compromising natural pest control. Nazira Qureshi Kamal, the head of BRRI's Entomology Division and LITE's in-country coordinator, points out that the mere presence of insects on the crop can panic farmers into spraying.

But it is not enough for a scientist to tell farmers, hey, don't bother with insecticides. An outsider, with all the best intentions in the world, won't be believed. And so it was that thousands of Bangladeshi farmers became agricultural scientists themselves.

The two nongovernmental organizations working with LITE — AID-Comilla in Comilla and, 300 km northwest of Dhaka in Rangpur, Debi Chowdhurani Poribar Unnoon Kendra (DCPUK) — taught lead farmers how to conduct a simple experiment by partitioning their fields into quadrants receiving different

Insecticide No leaf color chart	No insecticide No leaf color chart
Insecticide Leaf color chart	No insecticide Leaf color chart

LITE RICE FIELD: Lead farmers partitioned their fields into quadrants receiving four different crop-management strategies.

management strategies, with and without spraying and the LCC (see figure above). Other participating farmers bisected their fields, spraying one half but not the other.

Each lead farmer helped four other farmers carry out the experiment and record their insecticide and fertilizer costs for each treatment in specially designed notebooks. Recording the data themselves lent farmers a sense of ownership over the project, and their supervisory duties earned lead farmers self-confidence and the respect of the other farmers, who, being social equals, were neither intimidated nor distrustful. To ensure the accuracy of the data, Dr. Jahn and Orsini paid unannounced visits to randomly selected farmers to verify their measurements.

Augmenting the farmers' data, BRRI technicians collected insects from the LITE fields to determine how neighboring crops and insecticide and urea applications affect the diversity of rice pests and their natural enemies. Insecticides caused the greatest loss of overall biodiversity, perversely reducing the diversity of natural enemies more than that of pests.

AID-Comilla founder Abul Kalam Azad stresses that the key to LITE's success is its simplicity. "A previous pest-management project I worked on was technically complicated," he explains. "It took 6 months to train the farmers, and they couldn't remember everything. As well as being poor, many farmers in Bangladesh are illiterate. They can't easily adopt complicated technologies. With LITE, the technology and the message are very simple — LCC, no insecticide."

Wildest dreams

"We quickly realized," says Dr. Jahn, "the most important thing to focus on was scaling LITE up. We've already trained 2,000 farmers. We've reduced insecticide use among participating farmers by 99%, and by 90% among nonparticipating farmers in the same villages. Even in the control villages, where no farmers conducted the experiments, the proportion of farmers using insecticide dropped from 80% to 55% — largely because of casual contact with participating farmers.

"Our initial goal was to have 10% of farmers in the target villages reduce their insecticide use," he adds. "The result is beyond our wildest dreams."

LITE farmers' optimism is palpable. The day after Orsini drew a Thai victory chant from 3,000 participants — the Comilla region's 120 original lead farmers plus the current round of newly recruited participants — Dr. Jahn met the leaders to thank them for their hard work. After another chorus of "*chai yo*," a couple of farmers suggested the organizers reciprocate with an "American farm song." So it was that an IRRI senior scientist, a former UN scale-up expert and an Australian reporter (yours truly) found themselves moo-moo-mooing a hastily arranged but surprisingly well-received rendition of *Old Macdonald Had a Farm*.

In terms of cost-benefit, LITE is extremely successful. Orsini

FOUR WOMEN THRESH rice in the village of Sullipara, Rangpur. Farida Yasmin (*left*), a 17-year-old from Ghilatoli, Comilla, shows an environmental award she received for her role in the LITE project. Many of the farmers' wives and daughters helped to run, and participated in, double-blind taste and quality tests of rice grown under LITE's four crop management strategies. No differences were found. A Comilla farmer (*below*) bringing in the sheaves.

Double taka

Until a couple years ago, 35-year-old Joinal Ahmad (*pictured right*) grew rice on a little over half a hectare in his village of Tatoipara, annually eking out a farm income of 2,800 Bangladeshi taka, or US$48. He and his wife of 18 years struggled to look after their two toddler sons and put their two older daughters through school. In 2002, Ahmad was recruited by Livelihood Improvement Through Ecology (LITE) to test the effect of ceasing to spray insecticides on his rice crop. After establishing that spraying did not improve grain yield or quality, he did away with insecticides. He also reduced his nitrogen fertilizer (urea) use by employing a leaf color chart to guide applications.

While LITE hasn't made Ahmad wealthy, it has helped him a great deal. With the money he saves, he has been able to buy more land and boost his planted area to almost two-thirds of a hectare. He has cut his exposure to health- and environment-threatening chemicals. And he has almost doubled his annual farm income to 4,800 taka.

"I can grow rice at lower cost because I use less urea and no insecticide," Ahmad explains. "With the money I save, I help my family and pay for my children's education."

A few kilometers away in Ghilatoli, 20-year-old Mohammed Mashuk Miah (*pictured above, at right*), who combines rice farming with his accounting studies, enthuses about the difference LITE has made to him. His savings have capitalized a rice-milling business and helped him buy an ox. So keen is he to spread the good word, he has been teaching nonparticipating farmers on his own initiative.

"I tell other farmers to do the same thing," he says. "I invited 10 of my friends and trained them. They saw the faith I had in this method."

When farmers stop spraying, they save not only the purchase price of the pesticide but also on hiring labor and renting equipment — and on often exorbitant interest rates for the short-term loans they once needed to cover these costs. Many farmers have used their LITE-driven savings to buy more land or better-quality clothes and food for their families, and their newfound capital has allowed some to diversify into more profitable crops.

explains that the World Bank and other funding agencies traditionally consider projects worthwhile if they result in a 13% improvement in income. That is, for every dollar spent, the project must generate, after a certain number of years depending on its type, at least $1.13 of income. LITE's cost-benefit ratio is 1:4 — bringing a return of $4 for every dollar spent — in the first year alone, without factoring in subsequent years' savings.

"This will only get better with time," enthuses Orsini. "The longer that farmers use the LITE regime, the more they will save. After 5 years, say, the ratio will be 1:20, which is truly exceptional."

Dr. Jahn is confident that the farmers will adhere to LITE practices because, first, they saw the results of their own experiments in their own fields and, second, LITE goes straight to the bottom line. "Where farmer field schools rely on the farmers learning and understanding ecology," he explains, "LITE relies on understanding your wallet, which is almost innate."

The project's simplicity and direct appeal to farmers' interests are cited by the executive directors of both participating NGOs, AID-Comilla's Rokeya Begum Shafali and DCPUK's Nurul Islam Dulu, as strong arguments for more funding. "The last 2 years' results have been very good," says Shafali. "Now we need to explain the project, its aims and its mission to donors so that all Bangladeshi farmers have a chance to participate."

The LITE team now has 27 nongovernmental partners implementing the project — at their own expense, as LITE funding has finished — in 32 new villages in Comilla and Rangpur, which means that nearly 4,000 new farmers are being trained to perform the no-spray experiment. If additional funding comes through, each of these villages will provide lead farmers to train new lead farmers in five neighboring villages, for a total of 160 villages. The new lead farmers in those 160 villages will train the other farmers in their village, then new farmers in five more neighboring villages, and the number of villages practicing LITE will leap to 800. And so on.

Given continued support, LITE and its benefits will ripple and radiate across Bangladesh's rice fields. Perhaps someday soon, an incongruous but inspiring Thai victory cry will ring out all over rural Bangladesh.

Summing up

by Peter Fredenburg

In the calculus of rice and global food security, China and India equal the rest of the world combined. The role of rice research in these countries is likewise great, as is the task of coordinating it for maximum benefit

China and India together accounted in 1999 for 38% of world population and 55% of all rice consumption. In 2000, their rice fields comprised 48% of global area planted to rice and produced 54% of the harvest.

In the past year, responsibility for representing the International Rice Research Institute (IRRI) has changed hands in both countries. In September 2003, Tang Shengxiang completed 6 years of service as IRRI's first liaison scientist for China, replaced by Zhao Kaijun. Last June saw R.K. Singh complete 9 years as IRRI liaison scientist for India, where his responsibilities were assumed by J.K. Ladha as IRRI representative.

Transition in the two giants of the world of rice is an opportunity to celebrate the careers of the outgoing liaison scientists and to welcome their replacements in these two crucial IRRI country offices — after first recalling how the country-office system came to be.

For its first 3 decades, IRRI made do without ongoing country offices. The institute supported in-country research with project offices that were set up as needed and loosely linked to IRRI's Training and Technology Transfer Department and its deputy director general for outreach. The project offices — notably in India, Indonesia, Thailand and, starting in the mid-1980s, Vietnam, Cambodia and Laos — depended heavily on personal ties at IRRI headquarters in the Philippines to energize support for their activities.

Upgraded presence

Glenn Denning, head of technology transfer, drew on his experience in Indochina to champion systematizing the institute's in-country contacts by establishing permanent country offices. January 1990 saw the reorganization of the Training and Technology Transfer Department into the Training Center under Dan Minnick and the new International Programs Management Office under Dr. Denning.

Existing project offices became country offices that year, but significant upgrading of IRRI's presence in-country often depended on local initiative, as illustrated by R.K. Singh's start as liaison scientist in 1995.

"The first thing I did was shift the IRRI-India Office, which was then located in a back house of a residential premises, to a more decent premises in Friends Colony, New Delhi," reported Dr. Singh (it has since moved to the National Agriculture Science Center near other Indian and international agricultural institutions). "At the same time, we upgraded our office

WOMEN NEAR Hefei, in the Chinese province of Anhui, fertilize aerobic rice, a water-saving crop undergoing on-farm trials. Tang Shengxiang (*opposite top, at left*), IRRI's outgoing liaison scientist for China, checks a greenhouse trial with William Padolina (*right*), IRRI deputy director general for partnerships, and Chen Zonglong, vice president of the Yunnan Academy of Agricultural Sciences. R.K. Singh (*opposite bottom, holding water bottle*), outgoing liaison scientist for India, shares a light moment with farmers.

ARIEL JAVELLANA

R.K. SINGH (*right*) with Ren Wang, IRRI deputy director general for research, and N.V. Krishnaiah, principal scientist in the Entomology Department of the Directorate of Rice Research in Hyderabad, India.

equipment and sent local staff for training to enhance their knowledge and skills with regard to modern tools, equipment and office protocol."

IRRI-India was thus prepared to expand its list of projects from "only a handful," according to Dr. Singh, to the current "44 research projects implemented with 53 participating institutions involving more than 270 Indian scientists directly and many more indirectly" — all coordinated through regular IRRI-India planning and review meetings. Improved links with the private sector and nongovernmental organizations supported work in promoting traditional aromatic rice and organically grown and hybrid rice, as well as facilitating on-farm varietal trials and technology delivery. Strengthened ties with the media ensured routine press coverage of IRRI's activities in India.

Drawing on a decade's work from 1985 as director of research at Narendra Deva University of Agriculture and Technology in Faizabad, Uttar Pradesh, Dr. Singh was particularly active in several projects focused on eastern India, including research on mixed farming systems based on rice in rainfed lowlands and efforts to build partnerships with farmers through participatory varietal selection (see *Taking Part* in *Rice Today*, Vol. 3, No. 2, pages 22-26). He published research results in the books *Physiology of Stress Tolerance in Rice* (1996), *Rice-growing Environments of Eastern India: An Agro-climatic Atlas* (1999), *Rainfed Rice: A Sourcebook of Best Practices and Strategies in Eastern India* (2000), and *Boro Rice* (2003).

"During my tenure, I have also devoted some time to improving indigenous scented rices in India," Dr. Singh recalled. "My efforts in this regard have helped identify a number of improved lines, which are now being tested in state and all-India coordinated trials. Some have been released by state and central varietal release committees."

Dr. Singh co-edited two comprehensive books on the topic: *Aromatic Rices* (2000) and *A Treatise on the Scented Rices of India* (2003). One other book published by Dr. Singh, *Genetics and Plant Breeding*, is a manual and source book for postgraduate students. A fellow of the Indian National Academy of Agricultural Sciences, Dr. Singh has additionally published dozens of papers, notes and abstracts in refereed journals, international proceedings and other venues. Today, he continues working to alleviate rural poverty with the nongovernmental organization Nand Educational Foundation for Rural Development.

Memorable events

"Some memorable events during my tenure included India becoming signatory to the international status of IRRI in 1996 and the IRRI-India dialogue in 1998," Dr. Singh reminisced. "A highlight of the latter event was the luncheon meeting hosted for the IRRI director general and scientists by our prime minister along with his cabinet colleagues."

Similarly, a highlight of Tang Shengxiang's tenure as liaison scientist for China was President Jiang Zemin's formal opening of the first International Rice Congress. The event — which attracted more than 1,000 scientists from around the world and garnered extensive press coverage in China — took place in Beijing in September 2002, just a year

Who's new

Change came with continuity on 18 June when J.K. Ladha started as the International Rice Research Institute representative for India. As IRRI coordinator of the Rice-Wheat Consortium for the Indo-Gangetic Plains since 1999, Dr. Ladha, an Indian national, has been a frequent traveler to his homeland during his 22 years at IRRI headquarters in the Philippines.

"I was the youngest IRS when I joined IRRI in 1982," recalled the energetic 52-year-old internationally recruited staff scientist. Because Dr. Ladha was posted to India as an internationally recruited staff member, his new job title is IRRI representative, not liaison scientist as when the post is filled locally.

Zhao Kaijun

ARIEL JAVELLANA

J.K. Ladha

IRRI

A fellow of the Indian National Academy of Agricultural Sciences, American Society of Agronomy, and Soil Science Society of America, Dr. Ladha brings a wealth of research experience to the IRRI-India Office. "This will be a challenge," he said as he prepared for the move. "I'm a scientist, and I'll continue to look after my research. At the same time, the job involves a lot of administration."

In China, Zhao Kaijun came to the position of liaison scientist in October 2003 from the Chinese Academy of Agricultural Sciences in Beijing. Having obtained his doctorate in plant genetics and breeding in 1990 from the academy's graduate school, he taught rice biotechnology in its Institute of Crop Breeding and Cultivation and was deputy director of its Key Laboratory of Crop Genetics and Breeding under the Ministry of Agriculture.

The 42-year-old Dr. Zhao is co-holder of a U.S. provisional patent on plants resistant to fungal disease and the process of genetic modification that created them.

before Dr. Tang's departure.

His career with IRRI had begun in 1980, barely half a dozen years after the first tentative contacts between the institute and China, and only 4 years after the end of the Cultural Revolution. The rice scholar studied frequently at IRRI during the 1980s. In 1990, a year after becoming head of the Germplasm Department of the China National Rice Research Institute in Hangzhou, Dr. Tang became the China national coordinator of the IRRI-sponsored International Network for Genetic Evaluation of Rice (INGER, see *Joint Account with Interest* on next page).

Following a stint as an IRRI consultant in 1996-97, Dr. Tang accepted appointment as liaison scientist for China — which, surprisingly, did not yet have an IRRI country office. A frantic month's preparation led in November 1997 to an IRRI-China dialogue in Beijing, at which 45 rice scientists set priorities for a more formal program of collaboration.

From its newly established premises in the Beijing compound of the Chinese Academy of Agricultural Sciences, the IRRI-China Office initiated several collaborative projects on molecular breeding, hybrid rice development and use, aerobic rice breeding, rice functional genomics and shuttle breeding. Joint studies on nitrogen-use efficiency came under the project Reaching Toward Optimum Productivity. Collaborative research on exploiting crop biodiversity for sustainable rice-disease management developed a suite of techniques that Chinese farmers now apply on more than 1.2 million ha in the provinces of Yunnan, Sichuang and Jiangxi.

"We now have 18 ongoing bilateral collaborative projects that engage 160 Chinese scientists in 38 participating institutions," reported Dr. Tang.

The scientist noted that INGER germplasm has figured in 37 conventional rice varieties and 28 commercial hybrids released to Chinese farmers. "In the past 6 years, we arranged the delivery of more than 220 Chinese rice varieties to the International Rice Genebank at IRRI," he added.

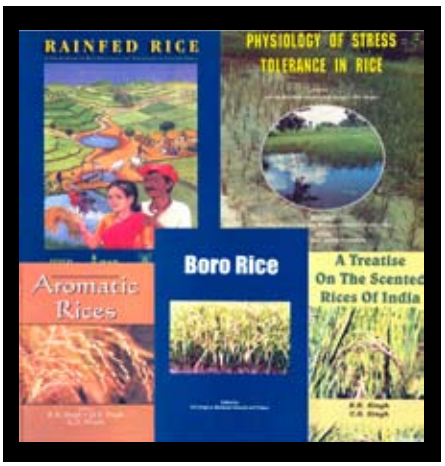
MADELYN LAPITAN

TAKING A BREAK during a meeting in Beijing are (*from left*) Mark Bell, head of the International Programs Management Office (IPMO); Margaret Ann Jingco, IPMO administrative coordinator; Tang Shengxiang, outgoing liaison scientist for China; Jojo Lapitan, IPMO senior manager; and Wang Zhongqiu, IRRI-China administrative coordinator. The covers of five books (*below*) that contain rice research by R.K. Singh.

The IRRI-China Office has been a 2-way conduit of rice information, with Dr. Tang writing about IRRI in the Chinese media and publishing many scientific papers in both Chinese and English, and the office annually shipping some 200 issues of 18 Chinese rice-related scientific journals to the IRRI Library. In 2002, Dr. Tang was instrumental in arranging publication, with the financial support of the Fujian Science and Technology Publishing House in Fuzhou, of the Chinese-language version of the 3rd edition of *Rice Almanac*, for which he also served as one of the two chief translators.

Timely inputs

Among the many Chinese awards received by IRRI scientists on Dr. Tang's watch was a 1999 first prize from the Ministry of Education recognizing his own research on the origin and evolution of rice.



Dr. Tang is continuing to serve as the Hangzhou-based INGER national coordinator and will complete his 2002-05 term as China regional secretary of the Society for the Advancement of Breeding Researches in Asia and Oceania.

Today, IRRI maintains country offices in Bangladesh, Cambodia, China, India, Indonesia, South Korea, Laos, Myanmar, Thailand and Vietnam, with the central International Programs Management Office serving as the Philippine country office — and will soon open a country office in Nepal. Staff consolidation brought restructuring full circle as the central office and the Training Center recombined in 2002 under the leadership of Mark Bell.

"IRRI's success depends on effective sharing of improved technologies with stakeholders — and on timely inputs from national partners to help set research priorities," said Dr. Bell. "We have helped our country offices facilitate these exchanges by standardizing operating procedures, but local leadership still counts for a lot. We've been fortunate to enjoy the services of such distinguished liaison scientists as Dr. Singh and Dr. Tang. As we adapt to changing needs in country offices across Asia, I hope and expect that we will continue to attract the dedicated liaison scientists we need."

An international rice network celebrates 30 years of impressive returns from the exchange of genetic assets

Joint account with interest

by Edwin L. Javier
and Maria Concepcion Toledo

A certain cooperative bank generates resources for agricultural development by pooling its member countries' assets. The countries deposit these assets without taking them out of circulation at home. India, the largest depositor, has withdrawn 10 times as much as it has deposited. Many countries, most recently Cambodia and East Timor, have made withdrawals without first making a deposit.

This marvelous "bank" is the International Network for Genetic Evaluation of Rice (INGER), soon to celebrate 3 decades of sharing elite rice germplasm — seeds and the genetic material they contain — across Asia and the rest of the world. Called the International Rice Testing Network when it was launched in 1975 by the International Rice Research Institute (IRRI) and its national agricultural research and extension system (NARES) partners, INGER has served as the recruiting office of the Green Revolution.

Between the late 1960s and the mid-1970s, IRRI developed the first modern rice varieties, whose short, sturdy straw could bear high yields without lodging (falling over), and whose insensitivity to the time of year — and corresponding length of day — meant that they would grow normally whenever they were planted. Unlike traditional varieties, which could produce only one crop per year, modern varieties allowed two or even three crops annually on a single plot of land. Breeders created these modern varieties by hybridizing varieties from different countries, then selecting improved progeny over the years to achieve a genetically stable, inbred cultivar. Demand for these improved varieties came from various parts of the world,

THE REARVIEW MIRROR of a motorcycle looks back on 1975, the foundation year of the International Network for Genetic Evaluation of Rice (INGER), and two International Rice Research Institute staffers reading up on the International Rice Testing Network, as it was then known. A rice nursery package is laid out for final contents check (*below*) before being strapped shut (*bottom*) in 1978. Today, the INGER Information Service (*above*) enhances a 30-year tradition of partnership with modern communication technology.

both to extend directly to farmers as cultivars and as parental material that national programs could use to breed new varieties to meet the burgeoning demand for rice.

The main role of INGER over the years has been to assemble and distribute rice germplasm and to analyze, interpret and disseminate the results of varietal evaluation and use, both as breeding material and in farmers' fields. INGER receives the best rice varieties and advanced breeding lines developed by NARES, IRRI and three of its sister centers in the Consultative Group on International Agricultural Research (CGIAR): the West Africa Rice Development Association (WARDA) – the Africa Rice Center; the International Center for Tropical Agriculture (CIAT by its Spanish acronym); and, until it discontinued its rice-breeding program in the mid-1990s, the International Institute for Tropical Agriculture (IITA).

Researchers multiply germplasm materials and organize them into nurseries, each of which undergoes evaluation under a particular target environment. Some nurseries target a particular ecosystem (irrigated lowland, rainfed lowland, upland or deepwater) and others a particular agronomic stress (tungro virus, blast, bacterial blight, gall midge, stem borer, brown planthopper, low temperature or various problem soils). Researchers create new types of nurseries as the need arises.

The INGER program at IRRI assembles nurseries both for global use and to meet the special needs of Asian countries. INGER Africa, led by IITA from the mid-1980s to the mid-1990s and now by WARDA, establishes specific nurseries for Africa. INGER Latin America and Caribbean, at CIAT, has looked after the particular needs of that region, in cooperation with Fondo Latinoamericano para Arroz de Riego, a public-private partnership for international research on rice.

Global perspective

INGER owes its success partly to its ability to work regionally while maintaining its global perspective. It has also enjoyed generous support from donors, notably the United Nations Development Program (1975-96), World Bank (1991-96), Swiss Agency for Development and Cooperation (1995), and Federal Ministry for Economic Cooperation and Development/German Agency for Technical Cooperation (1995-97). Today, IRRI, WARDA and CIAT support their INGER activities in their respective regions.

NARES rightly place a high priority on broadening the germplasm base of their national breeding programs, and INGER continues to be an integral component of NARES' testing programs. From its inception, INGER has relied on a technical advisory committee of representative scientists from participating countries to ensure that it meets the needs of NARES in line with their priorities

IRRI (4)

and capacities. The role of NARES was further strengthened when the Council for Partnership on Rice Research in Asia (CORRA), composed of senior officials of selected Asian NARES, became INGER's steering committee in 1999.

Janice Bautista, INGER database administrator, reports that India has made the most contributions to INGER, offering 1,400 varieties between 1985 and 2004 and receiving some 14,000 unique materials in the same period. In all, more than 23,000 unique elite varieties and breeding lines have been contributed to INGER by the four CGIAR and 79 NARES participants.

Genetic diversity

Many of these entries have undergone evaluation in more than one nursery. In its 3 decades, INGER has distributed more than 48,000 test entries to 74 countries around the world. Over the years, 62 countries have evaluated three to 6,345 selections in local yield trials. The INGER germplasm pool has directly supplied 667 varietal releases around the world, each saving local breeders 4-5 years' work. A study in 1997 calculated the annual value of each directly released INGER variety at US$2.5 million. Without INGER, the number of rice varieties released worldwide would fall by a quarter.

INGER nurseries have also served as a major source of parents for breeding. Since INGER's inception, 51 countries generated at least 17,000 crosses using INGER materials from 68 countries as parents. Like direct INGER releases, the resulting new varieties using INGER parents have improved farmers' income by offering high yields that are stable because the cultivars tolerate environmental stresses. They have reduced dependence on pesticides because they have multiple resistance to pests and diseases. INGER has also broadened genetic diversity in farmers' fields.

Less-developed countries have benefited the most from INGER. Cambodia, which missed the Green Revolution in the 1970s because of civil strife, has drawn from the INGER germplasm pool many materials that have become farmers' varieties. East Timor suffered crippling civil disturbances after its 1999 vote for independence. Now, with support from the Australian Center for International Agricultural Research, INGER's newest member has started searching for materials adapted to East Timor's rice-growing environments (see *Precious Cargo* in *Rice Today*, Vol. 2 No. 2, pages 20-23).

Yet, for all its success, INGER faces many challenges. Members of the World Trade Organization — that is, most countries — are required to have laws on intellectual property rights and plant variety protection. Many NARES became reluctant to share their germplasm, fearing that their materials may be misappropriated, and so undermining the INGER tradition of unrestricted flow of rice germplasm. Variety contributions to INGER started to decline in the mid-1990s.

In response to this changing environment, IRRI has sponsored meetings and workshops to raise NARES' awareness of intellectual property rights issues. CORRA now requires that all seeds received and distributed by INGER have material transfer agreements barring recipients from claiming any form of intellectual property protection on the material or related information. These measures have been effective, and INGER started to receive more contributions from NARES in 2003. Further upgrading of the International Rice Information System, which houses INGER genealogical and evaluation data, will package all intellectual property information associated with INGER germplasm.

Changing plant-quarantine regulations in many countries also affect the global movement of rice germplasm. For example, some countries require a phytosanitary certificate guaranteeing that seeds are free of certain bacterial pathogens. This presents a big challenge, as there are no standard international tests for those pathogens. The Seed Health Unit at IRRI is developing simple procedures for submission to the Plant Disease Committee of the International Seed Testing Association.


Liberia, 1983


Myanmar, 1980


Seed file at IRRI, Philippines

Meanwhile, growing demand for INGER materials is straining the program's limited budget. This year, its technical advisory committee identified innovations to help cope. The program will prioritize nursery types and testing sites and identify in-country multiplication sites for INGER materials to allow more requests for germplasm to be handled without crossing national borders. INGER will also start charging for seed orders from clients in the

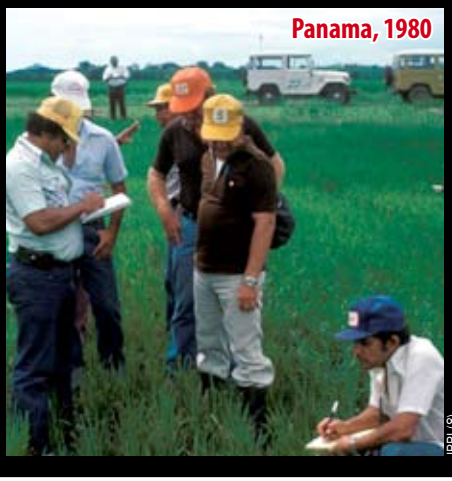
Demo plot at IRRI, Philippines

A WORLD MAP drawn in 1975 links IRRI headquarters in the Philippines with the 40 or so national programs then participating in the new rice evaluation network.

Guatemala, 1980

Thailand, 1985

The International Network for Genetic Evaluation of Rice owes its success to its ability to work regionally while maintaining a global perspective



Panama, 1980

IRRI (8)

private sector and those working with advanced research institutions or projects with available funds.

A program about people

In its 30-year history, INGER has distributed 2.6 million seed packets of elite germplasm. Today, however, the program's NARES partners require different types of germplasm and information. In response, INGER envisions facilitating the exchange, not just of elite germplasm, but of all types of genetic material including hybrids, genetic stocks, genetic mapping populations, segregating populations and transgenics — all, of course, subject to the plant-quarantine and biosafety regulations of the importing countries.

To understand how plant genotypes and their environment interact, the program will start characterizing sites with the modern tools of geographic information systems. Researchers will also use "probe" varieties, which react in different ways to specific stresses, to learn what stresses are present in a particular area.

In the final analysis, INGER is more than a network for germplasm exchange and evaluation. At its heart, the program is about people.

"INGER is a beautiful illustration of humanity working together for our common future in a world filled with social conflicts, tribal wars and fierce competition over the control of natural resources," comments Gelia Castillo, an eminent social scientist and IRRI consultant. "We must continue to share these agricultural treasures, even as countries declare national sovereignty over plant genetic resources. After all, rice is life."

Dr. Javier is a plant breeder at IRRI and coordinator of INGER. Ms. Toledo is an assistant scientist in INGER.

MELISSA FITZGERALD (*center*) and the first staff assigned to the new Grain Quality and Nutrition Research Center at IRRI, (*from left*) Teody Atienza, Juanny Alzona, Puring Sandoval and Dory Resurreccion, pose before some of the new equipment. Work began in temporary quarters as renovations continued on the US$1.2 million, 500-square-meter lab.

AILEEN DEL ROSARIO-RONDILLA

Quality time

by Peter Fredenburg

Rice scientists have long focused on helping Asian farmers reap bountiful and reliable harvests of affordable rice. Now they are taking up the additional challenge of improving the staple grain's nutrition and palatability

Gary Atlin recalls a meeting in 2001 of rice breeders in Delhi, India, that aimed to save the International Rice Research Institute (IRRI) and its national partners from wasting resources on promoting improved rice cultivars that farmers would not accept.

"There are lots of requirements to fill," explains the Canadian rice breeder, who had started at IRRI only the year before. "You need your agronomic traits like high yield potential, disease and pest resistance, and tolerance of problem soils, flooding and drought. And you need your grain quality traits, which vary from place to place, but generally include taste, aroma and texture. But in India we heard repeatedly about farmers who rejected a rice variety because they didn't like it *the day after they cooked it*. I thought, 'Man! This is just too hard.'"

Dr. Atlin still breeds rice at IRRI and swears by enlisting farmers in participatory varietal selection (see *Taking Part* in *Rice Today*, Vol. 3 No. 2, pages 22-26). Satisfying Asia's barefoot rice connoisseurs is still hard, but with the opening soon of IRRI's new Grain Quality and Nutrition Research Center, the job may get easier.

"How much rice hardens when it cools is one aspect of cooking quality," confirms Melissa Fitzgerald, who recently joined IRRI to set up the center and head its operations. "Of course, we also look at how hard or soft it is when freshly cooked. Is it sticky or dry and fluffy? Looking at the uncooked grains, are they uniform in size and shape? Are they whole, or are a lot of them broken? Are they chalky or nicely translucent? Are they white or tinged with yellow?"

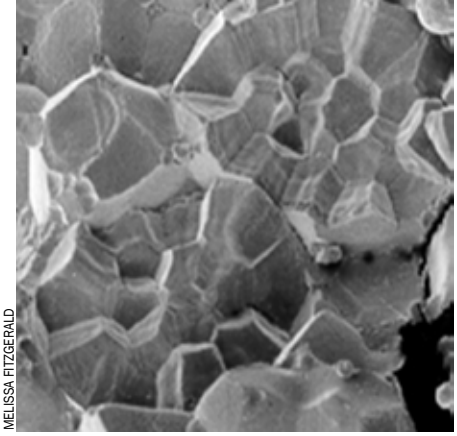
Dr. Fitzgerald's job is to get a handle on these attributes — one that stands up to scientific measurement and analysis.

"People talk about grain quality using adjectives, but rice is made of nouns — starch, proteins and lipids, or fatty acids," she points out. "The research program we're starting here is for understanding the nouns and how they interact to form translucent, white grains. Research is just at the point of learning what 'hardness on cooling' means in terms of the nouns."

In addition to conducting research, the center will perform a service for breeders, screening their lines for desired quality traits.

"I want to tailor the quality-evaluation program to meet each breeder's needs," Dr. Fitzgerald emphasizes. "Take the problem of chalk, which occurs in rice grains when starch granules fail to pack tightly enough to create a translucent, firm grain that mills well. The cause is usually environmental or agronomic, but it can be genetic. When a breeder brings us a chalky grain sample, good quality evaluation includes identifying the cause. This will ensure that breeders don't waste time trying to breed out chalkiness that isn't genetic."

And what about aroma, the quality that wreathes jasmine and



MELISSA FITZGERALD

basmati in what their admirers consider the essence of heaven?

"We're not sure yet how aroma fits into IRRI's mandate," she replies. "But aroma is not just the jasmine and basmati kind. Aroma conjures more adjectives, not all of them nice — creamy and vanilla, but also grassy and metallic. We'll be maintaining the equipment to measure aroma, but focusing on all aromas, not primarily on the volatile compounds unique to jasmine and basmati."

New framework

IRRI is establishing the Grain Quality and Nutrition Research Center now in response to calls for improved grain quality emanating from recent meetings of the Council for Partnerships on Rice Research in Asia. Since 1996, the council has guided partnerships teaming IRRI with the national agricultural research and extension systems of 16 Asian countries.

Regarding nutrition, the center fits into a new framework created by Harvest Plus, a challenge program launched last year by the Consultative Group on International Agricultural Research (CGIAR), IRRI's parent organization. Harvest Plus coordinates a concerted, cooperative research effort to get meaningful amounts of essential vitamins and minerals into the staple foods that even the poorest of the poor can afford, if only because no food is cheaper (see *Breeding for Nutrition* in *Rice Today*, Vol. 2 No. 2, pages 24-26). IRRI participates by breeding tropical indica versions of provitamin A-rich Golden Rice and by developing high-iron rice (look for exciting research results expected to be published soon in a refereed scientific journal).

In a 2002 proposal to set up the center, Robin Graham, a professor at the University of Adelaide in Australia and the scientific coordinator of the CGIAR Micronutrients Project, the forerunner of Harvest Plus, lamented that IRRI breeders working on high-iron rice "were sending their samples to Adelaide for analysis because trial analyses in the Analytical Service Laboratory at IRRI were unacceptable."

Prof. Graham surmised that the laboratory's failure to perform exacting micronutrient analyses resulted from "highly likely" contamination from its other activities, including soil analysis. A plant micronutrient laboratory, he wrote, "requires a contamination-free environment, with a positive-pressure ventilation system and largely metal-free lab furniture, fittings and facilities. For example, paint needs to be acrylic and carefully chosen for its low content of heavy metals."

He noted, "This obviously can be expensive." But IRRI needed to ante up. Otherwise, it would fall behind as an emerging "productive, sustainable and nutritious food systems paradigm," elucidated by Prof. Graham and others, redefines agriculture's role in human health.

"The tried and proven approach to balanced nutrition of the past is to promote a highly varied diet to ensure that everyone receives all the nutrients required, whether they be known to science or not," the Australian professor wrote in the proposal. "But such diets are relatively expensive and not available to the resource poor in developing countries of the South."

Grain quality is thus a vital health issue, especially for poor rice farmers and consumers. It is also key to adding value to the crop and so alleviating rural poverty. That the job of running IRRI's Grain Quality and Nutrition Research Center should go to Prof. Graham's fellow Australian is no surprise, as that country's small but strongly export-oriented rice industry has built its solid market presence on a foundation of high quality.

"When I took over our quality-evaluation program in Australia from Tony Blakeny, I continued developing objective, instrumental means of evaluation to replace subjective means," says the youthful Dr. Fitzgerald, whose dynamic career has included work as a cereal chemist and research scientist at the New South Wales Department of Agriculture's Yanco Agricultural Institute. "I also set up the research program there to understand quality, so we'd know just what it is we're evaluating. Here at IRRI, I'm setting up both programs at once, building on the foundation of Tony's vision and continuing my research. It's a great opportunity."

The startup cost for the 500-square-meter center is US$1.2 million. IRRI's million-dollar stake, drawn from unrestricted core funds, is evenly split between building renovations and equipment purchases. A further $200,000 from the Monsanto Fund is earmarked for equipment. On Dr. Fitzgerald's staff will be six Philippine scientists. Using temporary facilities, the team started performing quality evaluations in June on what breeders call "the 12 mega varieties" most widely grown in Asia.

"These were bred for agronomic traits and to improve quality," Dr. Fitzgerald says. "But we need to understand what to look for."

IRRI

INSPECTING RICE at IRRI in 1999 are (*from left*) Howarth Bouis, director of the Harvest Plus biofortification challenge program of the Consultative Group on International Agricultural Research; Glenn Gregorio, the plant breeder leading IRRI's work on high-iron rice; and Robin Graham, scientific coordinator of what was then the CGIAR Micronutrients Project. Prof. Graham championed setting up the lab to improve the health and well-being of poor rice consumers like the girl pictured below. Rice starch (*opposite*) magnified.

Starting with physical traits, she demonstrates a $45,000 Danish-made grain inspector that is "so new it's not yet released." The machine swallows a handful of grain and starts spitting out measurements: percentages of whole grains and broken, percentage of chalk, average grain length and its standard deviation, and average grain width and its standard deviation. Then it returns the whole sample unharmed.

Cooking quality

"Nondestructive testing is valuable because it allows us to do our cooking test with the same sample," Dr. Fitzgerald explains. "Sometimes breeders can spare us only a few grams of a new breeding line. And high-throughput is important because they give us so many to test."

A machine for testing cooking quality measures the changing viscosity of a slurry of rice flour and water as it is heated from 50°C to 95° and then cooled again to 50°. Two factors that affect cooking time and grain softness are gelatinization temperature (when heat causes the starch granules to swell irreversibly) and amylose content — both of which can be measured separately and automatically.

"Amylose accounts for up to 30% of the starch in rice, and amylopectin for the rest," Dr. Fitzgerald explains. "Waxy or glutinous rice — which is popular in Japan and in northeast Thailand and Laos — has little or no amylose. The rule of thumb is that the higher the amylose content, the firmer the rice. So you would expect the same cooking quality in two samples with the same amylose content, but the cooking processes of other components of the grain can be very different. In other words, there are plenty of exceptions to the rule. So we look at other things. Protein accounts for 5-9% of rice and can absorb a lot of water, so that's a factor. And we study the architecture of the starch. Small differences in amylopectin's molecular structure can lead to big differences in how the water is absorbed.

"And starch is interesting in terms of nutritional value, leaving aside protein and micronutrients," she adds. "We look at the rate starch is digested. Slowly digestible starch remains in the gut longer, so you feel full longer. What is the amount of resistant starch? How much of the stuff gets all the way through your small intestine without being absorbed? Resistant starch is good for bowel health."

Dr. Fitzgerald reports that her Australian experience in quality evaluation will be directly applicable to her work at IRRI, as will much of her own research there on protein, resistant starch and chalk. Meanwhile, the married mother of three clearly relishes her new horizons in the Philippines and the chance to round out her research experience.

"In Australia the rice is all japonica, but here it's almost all indica," she smiles. "That's nice."

A state-of-the-art gene-discovery facility in the Philippines has emerged as the buzzing hub of an inclusive community of cereal scientists and trainees

MARICHU BERNARDO prepares the microarray robotic printer as (*opposite*) young users of the Gene Array and Molecular Marker Application lab pose for a group photo. A portion of a microarray image lurks behind the headline.

MARK NAS

by Hei Leung and Marichu Bernardo

A happening lab

Rebecca Nelson, a plant pathologist at the International Rice Research Institute (IRRI) in 1989-96, recognized the need more than a decade ago. The institute, she said, needed a better mechanism for sharing with national agricultural research system (NARS) partners access to the expanding knowledge and tools of biotechnology — both concepts and hands-on skills.

With the help of the Asian Development Bank, the Asian Rice Biotechnology Network (ARBN) was born in 1993 to fill that need. A centerpiece of ARBN is its Training and Shuttle Research Laboratory designed for NARS researchers working on problems that require techniques or equipment not available at home. As the technical capacity of IRRI's NARS partners has evolved over the years, so have their technical-support needs. However, because the precision instruments required to study thousands of genes at one time are beyond the means of most laboratories, the logic of establishing a central place where people can converge to learn new techniques and share ideas as they conduct research is stronger than ever.

Since 2002, the Gene Array and Molecular Marker Application (GAMMA) lab at IRRI's research campus in the Philippines has played that central role. It provides, in the spirit of ARBN, more than 375 square meters of well-equipped research and training facilities for advanced molecular-genomics techniques.

GAMMA lets scientists analyze genes by the thousand, making discovery of gene function vastly more efficient than in the "old days" of a few years ago, when genes could be analyzed only one at a time. In the lab, researchers use robotics to "print" thousands of plant genes to fixed, carefully recorded locations on a glass slide. Separately, they prepare a mixture of genetic material reflecting two different conditions. Some of it may be taken from a plant that shows resistance when exposed to disease and is labeled with red fluorescence, for example, while the rest comes from a plant that shows susceptibility when exposed and is labeled green. Researchers introduce the mixture to the slide, where the genes hybridize with the printed genes in proportion to how strongly they were expressed in one or the other of the two plants.

Close scrutiny

In the resulting gene array for this example, a red dot at a particular location indicates relatively higher expression of that fixed gene in the resistant plant, and a green dot indicates relatively higher expression in the susceptible plant. The intensity of the red or green color shows how strongly the gene was expressed (a yellow dot, the result of adding red light to green, indicates a similar level of expression in both susceptible and resistant plants). Genes that are highly expressed in a resistant plant in response to disease, and minimally expressed in susceptible plants, likely encode the disease-resistance trait. These genes therefore merit closer scrutiny.

GAMMA also has equipment for high-throughput DNA fingerprinting of rice varieties and breeding lines to improve the speed and efficiency of marker-assisted selection (see *On your mark, get set, select!* in *Rice Today*, Vol. 3, No. 3, pages 28-29). Providing technical support and genotyping services to IRRI researchers and breeders, the lab can process over 8,000 samples per day — and is poised to gear up capacity as more breeding projects start to use marker-assisted selection. Over time, high-throughput fingerprinting adds value to the thousands of traditional and wild rice varieties conserved in the International Rice Genebank at IRRI by progressively mapping at the molecular level this largely unexplored panorama of rice biodiversity.

But GAMMA is much more than a genomics instrument room. It is a hub of community research and training for scientists from both IRRI and outside the institute. The mixing of expertise brought by researchers from near and far, their mutual learning experience, and their camaraderie are in fact what make it such a vibrant place, humming with activity. On any given day, about 20 researchers, scholars and trainees mill around the facility, busy with different tasks. Since its inception, it has been a classroom for more than 275 people receiving various types of training (more than half of them from NARS partners) and the focus of three ARBN workshops on microarray and high-throughput technologies. Through these activities, students and researchers have enjoyed the chance to rub elbows with renowned scientists.

"The GAMMA lab has provided NARS scientists with a modern facility for genomics studies, as well as an opportunity to learn from, and work together with, our partners from IRRI and other countries," said Renando Solis, a Philippine Rice Research Institute scientist who has attended several workshops.

"The GAMMA lab is a 'master' learning laboratory for many upcoming, and already established, NARS scientists," added Shailaja Hittalmani from Bangalore, India. "It has nourished and polished our knowledge to help build a strong scientific culture through rigorous, hands-on training and continuous interaction with other NARS scientists."

Resources and tools

An additional benefit is that the GAMMA lab has become a receptacle for resources and tools from partners at advanced research institutions. GAMMA helped make IRRI attractive to the Beijing Genomics Institute as a partner for testing its whole-genome gene chips. The University of Nagoya scientist Tetsuko Takabe has used the facility to study salinity tolerance in barley and rice. Olivier Panaud of the University of Perpignan and other French collaborators have applied high-throughput genotyping to study the progeny of wide crosses between wild and cultivated rice species. Rod Wing of the University of Arizona and other researchers from the U.S. have used GAMMA to prepare gene libraries of all representative wild rices and to make them publicly available. The International Maize and Wheat Improvement Center, IRRI's sister center in the Consultative Group on International Agricultural Research, has used it to identify maize genes.

Such collaboration will flourish as IRRI continues to leverage GAMMA to stay abreast of the latest gene-discovery technologies.

Dr. Nelson, who is now director of the McKnight Foundation Collaborative Crop Research Program at Cornell University, participated in IRRI's second Microarray and Bioinformatics Training Workshop in 2002 and reflected on how her ARBN brainchild has matured. "It's a joy to see how far the ARBN team has come," she said. "The dedicated staff and the facilities now accessible through ARBN are a wonderful asset for rice researchers everywhere. The shuttle research facilities are available not only to rice scientists but also to other cereal researchers who can gain from the rice-genomics platform. It's exciting to see scientists working on rice, maize, wheat, sorghum, finger millet and teff [an African grain] using the GAMMA facilities."

"The GAMMA lab is an excellent model of how international centers can provide their constituents with expertise, training and facilities in state-of-the-art technologies," commented Jan Leach, professor of plant pathology at Kansas State University, who has participated in GAMMA training workshops and used microarrays printed by the lab. "This is an excellent example of a great idea that actually works!"

Dr. Leung is a senior plant pathologist in IRRI's Entomology and Plant Pathology Division. Ms. Bernardo, of IRRI's Plant Breeding, Genetics and Biochemistry Division, is manager of the GAMMA lab.

JAYSON TALAG

Specific benefits

by Roland J. Buresh

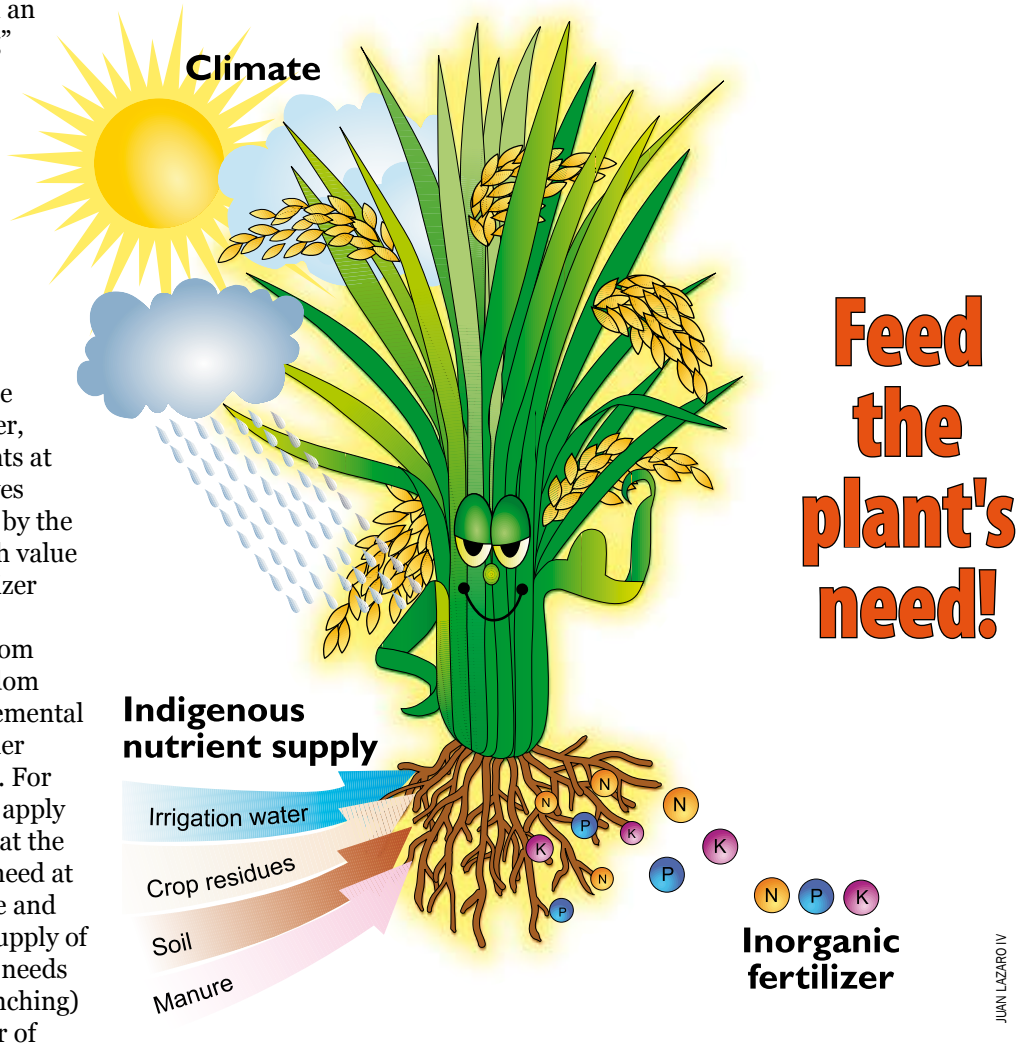
Farmers earn more from their rice crop by scientifically optimizing fertilizer use

The nutrients a rice plant requires for growth and sustenance come mainly from soil, crop residues and irrigation water. However, these naturally occurring, indigenous nutrients are typically insufficient to meet the needs of rice grown for high yield, which must receive additional nutrients to fill the deficit. Site-specific nutrient management (SSNM) provides farmers with an effective approach for "feeding" these supplements to rice.

Nitrogen (N), phosphorus (P) and potassium (K) are the nutrients rice requires in the largest quantities. The SSNM approach enables farmers to apply these nutrients optimally, as and when the crop needs them. It does not specifically aim to either reduce or increase fertilizer use. Rather, applying supplemental nutrients at optimal rates and times achieves maximum use of the nutrients by the rice, and so maximizes the cash value of the harvest per unit of fertilizer invested.

Because the supply of N from soil and organic sources is seldom sufficient for high yield, supplemental N is typically essential for higher profit from irrigated rice fields. For the best effect, farmers should apply N in several doses to ensure that the supply of N matches the crop need at critical growth stages. Effective and profitable N use requires the supply of N to be sufficient to meet crop needs at early and mid-tillering (branching) stages to maximize the number of panicles (grain bunches), at panicle initiation stage to increase spikelet (flower) number per panicle, and during the ripening phase to enhance grain filling.

SSNM provides two approaches for improved N management using a leaf color chart (see *Chart Hit for N Sync* opposite). In the "real-time" approach, farmers monitor the rice leaves and apply N fertilizer whenever they become more yellowish green than the critical value indicated on the chart. In the "fixed-time/adjustable-dose" approach, the time for N fertilization is pre-set at a critical growth stage, and farmers adjust the dose of N up or down based on leaf color.



JUAN LAZARO IV

Rice yields and the effectiveness of N use are often comparable for the two approaches. The fixed-time/adjustable-dose approach saves time and so is preferred by farmers who have gainful alternative activities, as often is the case in China and southern Vietnam. The real-time approach is generally preferred when farmers lack sufficient understanding of the critical stages for optimal timing of N fertilizer. In Bangladesh, net return with real-time N management, compared to that of farmers' practice, was on average US$41-65/ha better per season across five seasons. This approach is being promoted through the planned distribution of about 60,000 leaf color charts to Bangladeshi farmers in 2004.

Chart hit for N sync

by V. Balasubramanian

AILEEN DEL ROSARIO-RONDILLA

Farmers have long used leaf color as a subjective indicator of their rice crops' nitrogen (N) status. In 1994-95, IRRI and the Philippine Rice Research Institute developed, from a Japanese prototype, a leaf color chart (LCC) to help farmers in tropical and subtropical Asia monitor crop N status objectively, and so better synchronize N applications to field-to-field variation in N need. Simple, easy to use and, at less than US$1 per chart, inexpensive, the LCC is an excellent tool for crop N management in remote areas where no facilities are available for soil analysis.

The robustness and utility of the LCC technology is now well established, with many national universities and government departments of agriculture promoting it in Asia. As of June 2004, more than half a million charts had been distributed to farmers in six key Asian countries, with a smaller number distributed in 21 other countries in Asia, Africa and Latin America.

Two types of LCC circulate among farmers. The six-panel LCC depicts six shades from yellowish green to dark green; the four-panel version, introduced this year, drops the two panels at either extreme. In both versions, the color panels are textured with veins to reflect light as rice leaves do, and the background is a neutral gray. Pasted on the back is a simple instruction sheet in the local language.

Dr. Balasubramanian is a senior agronomist in IRRI's International Programs Management Office.

Optimal rate

Researchers, extension workers and farmers determine the P and K fertilizer requirements for a given soil type or rice-growing area with the nutrient-omission technique. They grow one plot of rice with abundant fertilizer supplements and use the yield thus achieved to calculate the full demand of rice for P and K. They simultaneously grow two other plots, one without added P fertilizer and the other without added K, and use those rice yields to estimate the indigenous supply of each nutrient. Subtract the indigenous supply of a nutrient from the total crop demand, and the remainder is the site-specific deficit. The optimal rate of supplementation fills this deficit and includes sufficient P and K to prevent depletion of soil fertility arising from their long-term removal in grain and straw.

With SSNM, farmers apply all P fertilizer within 14 days after transplanting, or 21 days after sowing, because P is vital for early rice growth. Potassium, on the other hand, is needed later to improve grain filling and resistance to diseases and lodging. Therefore, with SSNM, farmers often apply K fertilizer in two doses, the first half, like P, within 14 days after transplanting and the other half delayed until early panicle initiation.

Researchers developed the SSNM approach in the mid-1990s and evaluated it from 1997 to 2000 on about 200 irrigated rice farms at eight sites in Asia. Since 2001, the on-farm evaluation and promotion of SSNM have markedly increased. In 2003-04, SSNM was evaluated and promoted with farmers at about 20 locations in tropical and subtropical Asia, each representing an area of intensive rice farming on more than 100,000 ha with similar soils and cropping systems. The countries involved were Bangladesh, China, India, Indonesia, Myanmar, Thailand, Philippines and Vietnam.

Benefits multiply

The benefits of SSNM multiply when improved management of several nutrients is considered. On light-textured soils in the New Cauvery Delta of southern India, the approach results in increased K fertilizer use, and corresponding increases in rice yield and profitability, compared to both farmers' fertilizer practice and the fertilizer recommendation of the local extension service. In the Red River Delta of northern Vietnam, SSNM guided the development of specific P and K fertilizer management practices for each of the major soil types, and these are now undergoing on-farm evaluation and demonstration across the delta. In China, SSNM research demonstrated that hybrid rice needs more K fertilizer than conventional inbred rice to achieve its higher attainable yields.

Experiences from on-farm evaluation of SSNM across Asia indicate that many farmers of irrigated rice apply excess N during early crop growth, when crop demand for N is small, and then insufficient N at later growth stages such as panicle initiation, when crop demand for N is large. In addition, some rice farmers do not supply sufficient K fertilizer. Excess early N and insufficient K fertilizer can worsen the susceptibility of rice to diseases and insect pests. More and more, improved management of N and K fertilizer through SSNM is now reducing disease and insect damage in Asia, thereby reducing the need for pesticide.

Dr. Buresh is a senior soil scientist in IRRI's Crop, Soil and Water Sciences Division and the institute's program leader for favorable environments.

WHEN LATIN AMERICANS CELEBRATE RICE YEAR,

Arroz by another name …

Latin Americans, especially Brazilians, have been busy celebrating International Year of Rice 2004. *Ano Internacional do Arroz*, as it is known in Portuguese, got into full swing earlier this year with a conference and workshop on "Rice breeding in Latin America and the Caribbean: Review, current status and perspectives," held on 15-19 March in Goiania, Brazil.

The Brazilian Agricultural Research Corporation (Embrapa) promoted the event in partnership with the Colombia-based International Center for Tropical Agriculture (CIAT), France's International Center for Cooperation in Agricultural Research for Development (CIRAD), and the Food and Agriculture Organization of the United Nations. Attendees included scientists from Argentina, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Ecuador, Nicaragua, Dominican Republic, Peru and Venezuela, as well as private-sector representatives.

The conference covered the impact of national rice-breeding programs in Latin America and the Caribbean, the status of the region's ongoing breeding programs, and an open discussion on the future direction of breeding strategies.

Conference delegates endorsed a proposal to create a Rice Improvement Network for Latin America and the Caribbean. The network would promote broad cooperation in rice production, including the private sector, and facilitate germplasm exchange, technical training and fundraising. All participants supported the strategy as a way to fill the gap left by the recent inactivation of the International Network for Genetic Evaluation of Rice, Latin America and Caribbean.

National rice-breeding programs in Latin America and the Caribbean have developed similar priorities. Every country represented at the conference has aimed to improve rice yield, grain quality and resistance to major diseases like blast and grain spot. Thanks to the release of many new cultivars, the national programs have significantly contributed to yield increases and lower prices for consumers. Breeders have generated new cultivars through both traditional crossbreeding and induced mutations, and they have also made good progress in developing high-yielding hybrids.

The private sector breeds rice in all countries represented at the conference except Cuba, though biotechnology supports breeding programs in only 40% of them.

All countries present agreed that working together to integrate national programs and take advantage of each other's strengths was the way forward. Active participation in the Challenge Programs of the Consultative Group on International Agricultural Research was cited as a way to capitalize on international agricultural research centers' capacity to help solve regional problems.

CROWDS WATCH as the Agronomica, Brazil, rice harvest officially begins at a 12 March ceremony.

A number of presentations highlighted recent research advances that will soon produce practical results. These include new cultivars from wide crosses from CIAT, molecular-marker-assisted selection of breeding populations at Embrapa, regional breeding projects that team CIRAD and CIAT, and a biosafety project at CIAT.

The simultaneous Workshop on Breeding Selection organized field trips to upland and irrigated rice-growing areas, where participants had the opportunity to select lines from the Embrapa breeding program.

Beatriz Pinheiro, who was recently appointed director general of Embrapa Rice and Beans and was one of the prime movers behind the event, expressed her thanks to all attendees for helping to bring about an auspicious beginning in her new role.

Participants at the conference and workshop on rice breeding in Latin America and the Caribbean, held on 15-19 March in Goiania, Brazil.

EMBRAPA (6)

IT'S A *CARNAVAL* FULL OF BEANS

and aromatic, too

AT THE SCIENCE FOR LIFE FAIR, Beatriz Pinheiro, director general of Embrapa Rice and Beans, hands a newly released publication to Brazilian Minister of Agriculture Roberto Rodrigues, while Minister of Environment Marina Silva and Embrapa Director General Clayton Campanhola look on.

Scented rice caused a stir last May at the Science for Life fair in Brazil. *BRS Aroma*, a newly developed rice cultivar that produces grain with an aroma described as similar to that of jasmine or fine herbs, proved to be one of the most popular exhibits at the fair. Aromatic rice was new to most Brazilians attending the fair — but only one of many exhibits with a focus on International Year of Rice.

COOKBOOK EDITOR Marina Aparecida Oliveira autographs a copy.

The biennial fair at the headquarters of the Brazilian Agricultural Research Corporation (Embrapa), in the national capital of Brasilia, was held this year on 18-23 May. Embrapa Rice and Beans naturally played a lead role in organizing it.

The fair saw scientists present the latest innovations in rice and beans, including *BRS Aroma*, which was displayed in a special Rice House full of children's exhibits. Cartoons illustrated the importance of rice in Brazil and worldwide. The elementary school winners of rice-related computer games received prizes of Asian-style rice noodles made in Brazil.

The fair was also the venue for the release of several new publications from Embrapa Rice and Beans. The 40-page booklet *Arrozito e Feijó na Festa do AIA* (*Rice and Beans in the International Year of Rice Festival*) describes various rice cropping systems and processing procedures. It emphasizes the importance of rice in such nutrition programs as the Brazilian government's Zero Hunger initiative. Aimed at children and teenagers, the publication offers coloring activities, educational comic strips, crosswords and other puzzles.

Another publication aimed at young people is a 36-page booklet that outlines in simple language and beautiful illustrations how scientists develop genetically modified plants.

Other publications targeted consumers and industry. *O Arroz na Alimentação* (*Rice in Our Diet*) discusses the health benefits of rice, which is generally non-allergenic and an excellent source of complex carbohydrates free of gluten or cholesterol. The publication points out that the grain's nutritional value is enhanced when consumed as brown rice, parboiled or — a very Brazilian approach — combined with beans.

Utilização do Farelo de Arroz (*Rice Bran Utilization*) presents the case for rice bran as an excellent supplement to a diet designed to prevent malnutrition in infants and pregnant women. Bran, a low-cost milling byproduct, is easy to prepare, but humans consume only a small fraction of the 1 million tons produced each year in Brazil. The rest is used as animal feed or simply thrown away.

O Arroz na Indústria (*Rice Industrial Uses*) lists a variety of rice-based products, including toothpaste, noodles, animal feed, cosmetics, margarine and thermal insulation for buildings. The brochure discusses the potential of rice products to generate income and improve the Brazilian economy.

Finally, Embrapa Rice and Beans released at the Science for Life fair a cookbook entitled *Arroz com o Quê?*

LAURO TOLEDO DOS SANTOS (*center*), president of Sindarroz – Santa Catarina (Santa Catarina State Rice Union), launches International Year of Rice at a 13 January ceremony in Florianopolis, Brazil.

ADELOR VIEIRA, coordinator of the Santa Catarina Parliamentary Forum, discusses the celebrations on 7 May.

Wedding rice not thrown but sown

Marrying well is what some ethnic Karen farmers in the northern Thai village of Tee Cha do in an unexpected way. According to an award-winning scientific paper, families with marriage ties outside of the village grow rice crops that are better because they are more genetically diverse.

"This finding points toward the importance of kinship as a pathway for seed exchange," wrote the authors of *Varietal turnover and seed exchange: Implications for conservation of rice genetic diversity on-farm*. "Not only are marriage relations important routes of exchange, but many norms of exchange are deeply embedded in cultural practice. For example, Tee Cha villagers cite a rule that requires children to maintain a specific family variety after their parents' death. These findings are important because conservation initiatives that attempt to increase varietal exchange without understanding local practices might actually undermine the local systems of exchange that are crucial to the maintenance of diversity."

The paper won the IRRN Best Article Award in the Genetic Resources category, one of seven awards with

IRRN 29.2/2004
International Rice Research Notes

which *International Rice Research Notes*, now in its 29th year of publication by the International Rice Research Institute (IRRI), is marking International Year of Rice 2004. Its first author, **Anothai Sirabanchongkran**, a researcher in the Faculty of Agriculture at Chiang Mai University in Thailand, will receive US$500, as will the first authors of the other winning papers. Papers that have not yet been published in *IRRN* will appear in the December 2004 issue (29.2/2004), as will abstracts of the previously published papers.

"Many 'on-farm' conservation projects focus on encouraging continued planting of local varieties, and much effort is placed on stopping farmers from abandoning these varieties," stated the Thai and U.S. collaborators, who were funded by the Collaborative Crop Research Program of the McKnight Foundation. "But it was found that the rate of abandonment or 'variety turnover' was high, even when the number of local varieties grown in the village remained stable."

"One of the project's central findings is that in areas outside Thailand's main rice-production regions — totaling some one-fifth of the country's rice land — rice genetic diversity and the success of rice farming are closely linked," said Anothai. "Genetic variation in the local rice germplasm is not static, but is continuously being renewed and enhanced by farmers' seed management, with seed exchanges among farmers within and between villages identified as one key process. This has led us to investigate more closely the dynamics of varietal turnover, seed exchange networks and the relevant social processes."

Shuttle breeding

Winning the award in the Molecular and Cell Biology category was *Development of TGMS lines and two-line rice hybrids through a shuttle breeding program between IRRI and China*. First author **Mou Tongmin**, professor of plant breeding at the Plant Science and Technology College of Huazhong Agricultural University in Wuhan, has been researching genetics and hybrid rice breeding for 17 years, including a stint in 2002 as a research fellow at IRRI under tropical hybrid pioneer Sant Virmani.

His research team developed the first indica thermosensitive genic male sterile line and the first japonica photoperiod-sensitive genic male sterile line. The resulting japonica two-line hybrid rice was introduced in the Chinese province of Hubei in 1990 and now covers a planted area of 33,000 ha. In 2002-03, the resulting indica two-line hybrid was certified for use in Hubei, where it now covers 10,000 ha.

Indian meteorologist **G. Nageswara Rao** was the first author of the Socioeconomics category winner, *Advance estimation of rice production in India from weather indices*. Dr. Rao, who currently works under the United Nations Development Program as an assistant professor and head

IRRN Best Article Award winners' circle

Genetic Resources: *Varietal turnover and seed exchange: Implications for conservation of rice genetic diversity on-farm*. A. Sirabanchongkran, N. Yimyam, W. Boonma and K. Rerkasem, Faculty of Agriculture, Chiang Mai University, Thailand; K. Coffey and M. Pinedo-Vasquez, Department of Ecology, Evolution and Environmental Biology, Columbia University, USA; and C. Padoch, Institute of Economic Botany, New York Botanical Garden, USA

Molecular and Cell Biology: *Development of TGMS lines and two-line rice hybrids through a shuttle breeding program between IRRI and China*. Tongmin Mou, Chunhai Li and Junying Xu, National Key Laboratory for Crop Genetic Improvement, Huazhong Agricultural University, China; S.S. Virmani and D.L. Sanchez, IRRI

Socioeconomics: *Advance estimation of rice production in India from weather indices*. G. Nageswara Rao, Y.S. Ramakrishna, A.V.R. Kesava Rao and G.G.S.N. Rao, Central Research Institute for Dryland Agriculture, Hyderabad, India

Soil, Nutrient and Water Management: *Boron deficiency in calcareous soils reduces paddy yield and impairs grain quality*. A. Rashid and M. Yasin, Land Resources Research Program, National Agricultural Research Center (NARC); M. Ashraf, Crop Sciences Division, Pakistan Agricultural Research Council; and R.A. Mann, Rice Research Program, NARC, Islamabad, Pakistan

Pest Science and Management: Pseudomonas *strain GRP3 induces systemic resistance against sheath blight in rice caused by* Rhizoctonia solani. A. Pathak, A. Sharma and B.N. Johri, Department of Microbiology, College of Basic Sciences and Humanities; and A.K. Sharma, Department of Agroforestry, College of Agricultural Sciences, G.B. Pant University of Agriculture and Technology, Pantnagar, India

Crop Management and Physiology: *Chlorophyll fluorescence parameters as indicators of submergence tolerance in rice*. R.K. Sarkar, D. Panda, D.N. Rao and S.G. Sharma, Central Rice Research Institute, Cuttack, India

Plant Breeding: *Santosh — A high-yielding variety for rainfed lowland developed through participatory breeding for Bihar, India*. R. Thakur, N.K. Singh, S.B. Mishra, A.K. Singh and K.K. Singh, Rajendra Agricultural University, Samastipur; and R.K. Singh, IRRI-India Office, New Delhi, India

of the Meteorology Department at Arba Minch University in Ethiopia, collaborated on the paper with former colleagues at the Central Research Institute for Dryland Agriculture in Hyderabad, India.

The paper presents a model that estimates, using monthly rainfall data and the Southern Oscillation Index (indicating El Niño-La Niña fluctuations), India's total annual rice production 6-8 months before the harvest. "These advance estimates are very useful for the national government and planners as they make policy decisions about food security and the export and import of rice," explained Dr. Rao.

The author of several publications on various aspects of meteorology, Dr. Rao received the Young Scientist Award from the Indian government's Department of Science and Technology for his work on long-range forecasting of monsoon rainfall and water resources in the Godavari basin.

Another widely published scientist will receive the $500 award for the paper *Boron deficiency in calcareous soils reduces paddy yield and impairs grain quality*, which won in the Soil, Nutrient and Water Management category. First author **Abdul Rashid**'s 200 publications include the only soil science book produced in Pakistan. Internationally recognized for his expertise in micronutrient nutrition of crops, the chief soil scientist at Pakistan's National Agricultural Research Center is on the editorial board of the *European Journal of Agronomy* and has won several coveted awards and honors.

Mou Tongmin, (*continuing clockwise*) G. Nageswara Rao, Abdul Rashid, Ashutosh Pathak and Ramani Kumar Sarkar.

Multidisciplinary research

"As rice soils in Pakistan are calcareous [high in calcium carbonate, or lime] and low in organic matter, we suspected that boron deficiency might be a cause of low rice yields," Dr. Rashid explained. "Our research established that rice grown in the low-boron, calcareous soils of the major rice-growing areas of Pakistan not only suffers severe yield losses, but its grain quality is also impaired. We found that applying boron in such situations improves yield, cooking quality and farmers' income — substantially. This significant accomplishment was made possible by a multidisciplinary research team including soil fertility specialists, a plant physiologist and an agronomist."

The award for Pest Science and Management went to the paper Pseudomonas *strain GRP3 induces systemic resistance against sheath blight in rice caused by* Rhizoctonia solani. First author **Ashutosh Pathak** is a microbiologist now working for a water purification firm in the Indian state of Uttaranchal while serving as a faculty member and adviser in food technology at Allahabad University.

"This study started in 2000, when Prof. Johri had gone through all the details of sheath blight occurrence and losses due to this disease," recalled Dr. Pathak, referring to Bhavdish N. Johri, the coauthor under whom he received his doctorate from G.B. Pant University of Agriculture and Technology in Pantnagar, Uttaranchal. "He assigned to me this work in integrated pest management."

Dr. Pathak and his colleagues at G.B. Pant screened several bacterial cultures and found that the *Pseudomonas* fluorescence strain GRP3 exhibited both biocontrol and plant growth-promoting rhizobacteria properties. "We carried this study out on susceptible and moderately resistant varieties," he explained. "Susceptible varieties shifted to the moderately resistant or resistant group of rice cultivars, and moderately resistant varieties became resistant."

Anothai Sirabanchongkran.

The prize in the Crop Management and Physiology category went to a paper by a group funded by the Indian Council of Agricultural Research at the Central Rice Research Institute in Cuttack, Orissa.

"The group has been working on developing a suitable technique to screen rice varieties exhibiting submergence tolerance," explained **Ramani Kumar Sarkar**, senior scientist and first author of *Chlorophyll fluorescence parameters as indicators of submergence tolerance in rice*. "The traditional technique of submerging rice plants and then looking for survivors has helped in identifying submergence tolerance, but it results in the loss of valuable materials during screening. So we tried a nondestructive technique based on chlorophyll fluorescence parameters to differentiate between tolerant and susceptible genotypes."

Finally, the winner in the Plant Breeding category was *Santosh — A high-yielding variety for rainfed lowland developed through participatory breeding for Bihar, India*. The first author of the paper was **R. Thakur**, who collaborated with four of his colleagues at Rajendra Agricultural University, in the Indian state of Bihar, and with R.K. Singh, the recently retired IRRI liaison scientist for India (see *Summing Up* on page 18).

French mount rice exhibit in Philippines

ARIEL JAVELLANA

GELIA CASTILLO, Philippine National Scientist and IRRI consultant, tucks into some treats at the opening of the Rice Feeds the World exhibit.

Sixty officials and guests of the Philippine government, French embassy and France's Agricultural Research Center for International Development (CIRAD), Philippine Rice Research Institute, Asia Rice Foundation, and IRRI witnessed the opening of the Rice Feeds the World exhibit on 21 June in two shopping malls in the Philippine capital.

Renee Veyret, French ambassador to the Philippines, and Arthur Yap, then Department of Agriculture undersecretary (now secretary) and head of the National Food Authority, opened the exhibit. Developed in France and brought to the Philippines for the International Year of Rice, the interactive exhibition had already toured several other Asian nations, including Thailand and Myanmar. After a week in the Philippines, it went to Vietnam.

The French Agropolis Museum has information in French on the Internet about the exhibit (http://museum.agropolis.fr/pages/animations/air2004/index.htm).

The bricks-and-mortar Agropolis Museum in Montpellier, France, was scheduled to hold on 29 September a conference at which Guy Trébuil, CIRAD agricultural systems agronomist seconded to IRRI, would present the book *Le Riz: Enjeux Ecologiques et Economiques* (*Rice: Ecological and Economic Challenges*), which Belin Editions launched in Paris in July. The National Center for School Documentation of the French Ministry of Education will publish a 10-page summary of the book in the 1 October issue of its series *Texts and Documents for the Classroom*, which is distributed in 21,000 schools.

INDONESIA HELD its second National Rice Week at the Indonesian Institute for Rice Research (IIRR) in Sukamandi on 15-19 July. The celebration featured seminars, a rice walk, exhibitions and various contests for students and farmers. The event was attended by thousands of farmers, hundreds of whom had a chance to meet President Megawati Sukarnoputri, as well as the minister of agriculture and the minister of industry and trade. The president and her group saw how rice is crossed to breed new varieties. The photo shows President Megawati (*left*) with Mahyuddin Syam, IRRI representative for Indonesia.

A WINNING POSTER by fourth grader Rinnah Rhyza D. Guevarra from the Jehovah Shammah Christian Community School in Paciano Rizal, Bay, Laguna.

IRRI celebrates with its neighbors

An International Year of Rice mobile exhibit created by IRRI visited 23 schools in Bay and Los Baños, the institute's home municipalities, between March and August. The exhibit presented information on rice and its cultural, environmental, nutritional and economic significance, and the schools held essay, poster and cooking contests (*see picture above*).

On 4 August, the Los Baños Science Community sponsored a National Science and Technology Week event at IRRI. The day-long program included a symposium in the morning that attracted about 100 science community members and local dignitaries. Approximately 100 people, including 80 farmers, participated in an afternoon farmers' forum.

The Philippine Network for Ecotourism Development is planning a national youth camp for the sustainable development of rice on 25-28 October at the University of the Philippines, Los Baños. Participants will also tour IRRI's Experiment Station and Riceworld Museum and Learning Center.

- The United Nations Information Center-Tokyo opened on 17 July its annual summer exhibition at UN House in Shibuya. The exhibit featured various displays on rice, including the recently published Japanese translation of IRRI's own children's book *Graindell*. Keijiro Otsuka, chair of IRRI's Board of Trustees, visited the exhibit on 9 August.

China and Korea host meetings

The "International symposium on science and technology in agriculture: Current and future" was jointly held in Beijing by the Chinese Academy of Agricultural Sciences (CAAS) and World Food Prize Foundation on 10-12 July. Topics discussed included China and world agriculture in the 21st century, agricultural policy, international agricultural science and technology development and cooperation, issues of agricultural biotechnology, and hybrid rice.

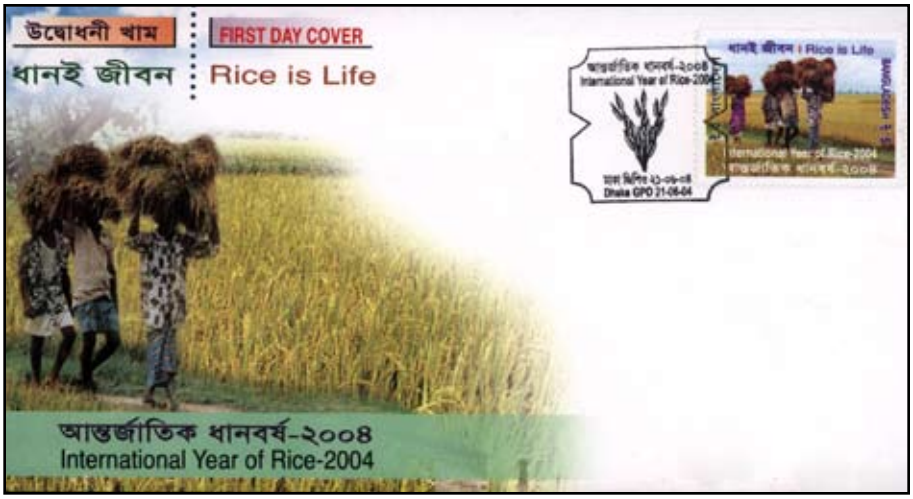
CAAS and the Chinese Ministry of Agriculture are supporting an "International conference on sustainable rice production" on 15-17 October in Hangzhou to mark International Year of Rice and World Food Day (www.chinariceinfo.com/rice2004/notice_1.htm).

The celebration of International Year of Rice in Korea was scheduled to culminate with the International Rice Science Conference in Seoul on 13-15 September. The theme was "Rice science for human welfare in the 21st century."

Celebration in Tamil Nadu, India

International Year of Rice was celebrated at the Tamil Nadu Rice Research Institute in Aduthurai on 25 June. B. Chandrasekaran, director of the institute, welcomed the gathering of eminent rice scientists, joint directors of agriculture of the districts of Thanjavur, Thiruvarur and Nagapattinam, officers of soil and pesticide testing laboratories, and farmers.

C. Ramasamy, vice chancellor of Tamil Nadu Agricultural University, lit the lamp that inaugurated the function. Dr. Ramasamy spoke on the need for research to add value to rice crops for export. He also released two books, *Paddy Cultivation – Questions and Answers* and *Microbes for Rice Production*, as well as the folder *Pepper Cultivation*.



BANGLADESH RELEASED on 21 June a first-day cover and postage stamp commemorating the International Year of Rice. The next day, the Bangladesh Agricultural Research Council held a seminar on "International Year of Rice 2004: Meeting the challenge for tomorrow" chaired by A.S.M. Abdul Halim, secretary of the Ministry of Agriculture. Minister of Agriculture M.K. Anwar was the chief guest and M. Sayeduzzaman, former finance minister, was the special guest. On 29 April, a seminar at the Bangladesh Rice Research Institute considered *A brief outline of 100 years of chronological development of rice research in Bangladesh*, presented by S.M.H. Zaman, former director general of the institute.

British publication focuses on rice

New Agriculturalist has put online a focus on rice that explores "some of the triumphs and tribulations of breeding, producing and communicating about rice," says the introduction at www.new-agri.co.uk/04-4/focuson.html. The topics are:

All hyped up for hybrid rice? "More than half the total rice area in China is currently planted to hybrid rice."

Rice — learning from the past? "In ancient times, the economy of the great city of Angkor, located in present-day Cambodia, was based on rice.... What cautionary tales from this once-mighty city can be communicated to the modern world?"

How rice farmers benefit from ICT. "Imagine walking into an Internet cafe and watching youngsters — bubbling with enthusiasm — taking delight in demonstrating the basics of computer use to their parents."

Eureka for NERICA! "Since the 1960s, imports of rice to West Africa have increased 8-fold, costing the region almost US$1 billion a year. But ... Africa may once again become self-sufficient in rice."

Red rice for self-reliance! "Bhutan's rice is red and so highly favored, even revered, by the Bhutanese that very little is available for export."

The golden future of rice? "Golden Rice has been hailed by researchers as a new miracle rice that could solve vitamin A deficiency in afflicted countries."

IN CELEBRATION of the International Year of Rice, Lao Vice Minister of Agriculture Ty Phommasak launched in Vientiane on 22 July a soap opera series promoting integrated pest management principles and practices to rice farmers. A team of scientists spent 18 months studying farming communities to develop characters and themes for the drama's 104 episodes. "We can use the drama to highlight the locally unappreciated dangers of pesticides," said IRRI entomologist K.L. Heong, who initiated the project in 2002.

Keeping up with IRRI staff

Glenn Gregorio, former IRRI international research fellow in Plant Breeding, Genetics and Biochemistry (PBGB), was named by the Philippine National Academy of Science and Technology as this year's Outstanding Young Scientist in the field of genetics. The award recognizes Filipino scientists up to the age of 40 who have made significant contributions to science and technology.

M.S. Swaminathan, 1987 World Food Prize laureate and former IRRI director general (1982-88), has been appointed chair of India's National Commission on Farmers. The commission was created in February to look into ways of improving farmers' livelihoods (see Rice in the News on page 11).

Hubert G. Zandstra, director general of the Peru-based International Potato Center and former IRRI deputy director general for research (1989-91), was honored in May with Peru's Great Cross for Distinguished Service. Dr. Zandstra was recognized for his contribution to research on the potato, sweet potato, and lesser known Andean roots and tubers.

Shaobing Peng, crop physiologist in Crop, Soil and Water Sciences (CSWS), was elected in June as a fellow of the American Society of Agronomy. **J.K. Ladha**, a soil scientist in CSWS, was elected as a fellow of the Soil Science Society of America. Both will receive their honors at combined annual meetings in early November in Seattle.

Hung-Goo Hwang recently joined PBGB as a senior scientist. Dr. Hwang studies germplasm utilization for value addition, supervises the off-season Korean Seed Multiplication project, and acts as a liaison between IRRI and South Korea's Rural Development Administration.

Thomas Metz recently joined the Biometrics and Bioinformatics Unit as an international research fellow. Dr. Metz, formerly a senior scientist at the International Plant Genetics Resources Institute, is integrating all sources of germplasm information into a single International Rice Information System.

Naga Chirravuri recently joined PBGB as a postdoctoral fellow to do marker-assisted selection for submergence tolerance.

Ramaiah Venuprasad recently joined PBGB as a postdoctoral fellow to detect alleles conferring reproductive-stage drought tolerance.

Stephen Zolvinski, who recently joined the Social Sciences Division (SSD) as a postdoctoral fellow, is the assistant network coordinator for the Consortium for Unfavorable Rice Environments.

Principal scientist retires after 29 years at rice institute

AILEEN DEL ROSARIO-RONDILLA

Tom Mew, former IRRI principal scientist and Entomology and Plant Pathology Division (EPPD) head, retired on 5 August after 29 years at the institute. EPPD honored Dr. Mew with a symposium on sustainable crop and disease management, which presented highlights of his research on seed health, bacterial blight, exploiting biodiversity for disease management, and biological control of rice diseases. Speakers discussed how Dr. Mew's research has improved the well-being of millions of poor rice farmers and consumers. IRRI consultant **Gelia Castillo**, who presented the keynote address, described Dr. Mew as a dreamer and positive thinker (see *The Tao of Tom*, in *Rice Today* Vol. 3, No.2, pages 16-21).

At a 30 May ceremony in Dhaka, the Bangladesh Rice Research Institute (BRRI) recognized Dr. Mew's outstanding contributions to improving rice farmers' seed-health practices for pest management and crop production in Bangladesh. BRRI also lauded his instrumental role in establishing its Seed Pathology and Molecular Laboratory and strengthening institute partnerships with government institutions, nongovernmental organizations and farming communities by promoting clean-seed technology in the country.

Dr. Mew will continue at IRRI as a consultant.

Takuhito Nozoe, an agronomist in CSWS, is leaving IRRI after 5 years' service. Dr. Nozoe identified important soil-related factors that suppress the growth of rice in irrigated soil, as well as the physiological activities of roots in relation to iron tolerance.

Yoshimichi Fukuta, a breeder in PBGB who researched the genetic basis of resistance to blast disease and performed pioneering studies of quantitative trait loci in rice, is leaving IRRI after 6 years' service.

Seiji Yanagihara, a breeder in PBGB for flood-prone environments and improved levels of tolerance for abiotic stresses, is leaving IRRI after 5 years' service.

Guy F. Trébuil and **Francois Bousquet**, French Agricultural Research Center for International Development scientists, completed in June their 3-year secondment to SSD. Based in Thailand, Dr. Trébuil, an agricultural systems agronomist, and Dr. Bousquet, a modeler-ecologist-economist, developed participatory approaches to natural resources management.

James Mullaney, former acting director for administration (1991) and consultant/adviser in the director general's office (1991-92), passed away in July.

Partners in progress

Ruben G. Echeverría has been named the new executive director of the Science Council of the Consultative Group on International Agricultural Research. **Jacques Diouf**, director general of the Food and Agriculture Organization of the United Nations, announced the Uruguayan's appointment, which was due to begin on 1 September.

Yuan Longping, winner of this year's World Food Prize, received the Wolf Prize in Agriculture in Jerusalem on 9 May. Prof. Yuan, director of the China National Hybrid Rice Research and Development Center and considered the father of hybrid rice, is "one of the scientific giants in the history of modern agricultural research," according to the Wolf Prize jury. He shared the prize with Cornell University's **Steven Tanksley**, who was recognized for his innovative development of hybrid rice and discovery of the genetic basis of heterosis in this food staple.

Cao Duc Phat became on 25 June acting minister of the Vietnamese Ministry of Agriculture and Rural Development.

Saving labor

by David Dawe
Economist

Boosting labor productivity on rice farms raises living standards, even for landless workers

Labor cost as a percentage of total rice production cost (excluding land rent) for seven rice bowls in Asia.
Source of raw data: 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 the productivity of intensive rice systems through site-specific nutrient management. Enfield, N.H., and Los Baños, Philippines: Science Publishers, Inc., and International Rice Research Institute. p 29-58.

Living standards can rise only as workers become steadily more productive. For rice farming, improving productivity means adopting such labor-saving innovations as broadcast seeding and mechanization, especially in the absence of breakthroughs that lead to higher rice yields.

Some would prefer to keep rice farming labor-intensive to preserve rural jobs, no matter how dead-end. The problem is that stagnant farm-labor productivity props up the retail price of rice and so undermines an essential foundation of living-standard improvement: household food security, or the ability of families to afford enough food to support a healthy, active life for all.

Most of the food-insecure in South and Southeast Asia are landless rural laborers, farmers who grow crops other than rice, and urban slum-dwellers — in other words, poor people who buy their daily rice, not grow it on their own land. Thus, an important component of household food security is lower retail rice prices.

These are sustainable only when the cost of production per ton drops. By far the main costs in rice farming are land and labor, so the key to lower production cost is using less land or labor or both. Higher yield with little additional input is one way to lower production cost because it reduces the land needed to grow a ton of grain. The other option is to reduce the labor input, which occupies by far the largest share of non-land production cost across Asia (see figure above). As labor's share of production cost exceeds that of other inputs, such as fertilizer and pesticide, the potential savings are commensurately great.

Among seven of Asia's major rice bowls, Thailand's Central Plain is the only one where labor cost is less than half of total non-land production cost (albeit still the most important item). Not coincidentally, the Central Plain has the lowest production cost — not from high yields but from reductions in labor input achieved during the past 20 years. Broadcast seeding has replaced transplanting, and harvesting and threshing have been mechanized with combines.

In China, transplanting is disappearing in many areas, and despite small parcel sizes, combines are being rapidly adopted, as they are in Punjab and Malaysia. While mechanization is not cost-effective now in areas with the lowest farm wages, reducing labor input is a major challenge facing Asian countries that wish to become more competitive in rice production.

To be sure, saving labor in rice cultivation has a price because many poor laborers receive a substantial portion of their income from available work in rice fields, and lower rice prices may force wages down. In the short run, laborers will have difficulty finding new jobs. However, because these laborers are rice consumers, they will also benefit from the lower market prices brought about by reduced production cost. Furthermore, most of these laborers have diversified sources of income off rice farms. Research is limited on how much agricultural wages adjust to changes in rice prices, but the best-known studies on this question (both done in Bangladesh) suggest that lower rice prices help more than lower wages hurt[1] or that lower rice prices do not lead to lower wages,[2] presumably because demand is substantial for labor outside of the rice sector.

Growth in the industrial and service sectors is nevertheless critical to ensuring that agricultural laborers can find new — and perhaps better — jobs to replace those lost in rice cultivation. This is something that both Thailand and China have successfully achieved.

[1]Ravallion M. 1990. Rural welfare effects of food price changes under induced wage responses: Theory and evidence for Bangladesh. Oxford Econ. Papers 42:574-585.
[2]Rashid S. 2002. Dynamics of agricultural wage and rice price in Bangladesh: A re-examination. Markets and Structural Studies Division Discussion Paper No. 44. Washington, D.C.: International Food Policy Research Institute. 40 p.

grain of truth

Biopirates or pioneering conservationists?

N.R. Sackville Hamilton
Head, Genetic Resources Center at IRRI

The genebanks of the Consultative Group on International Agricultural Research (CGIAR) are often portrayed in the popular press as villains, the archetypical biopirates who steal huge amounts of biodiversity from their rightful owners and ride roughshod over the rights of poor farmers. At the same time the genebanks are often portrayed as heroes, the saviors of biodiversity that would otherwise have been lost. Can we reconcile the two views? The truth resides in a newly implemented treaty.

Without the tiniest shadow of a doubt, CGIAR genebanks have prevented the wholesale destruction of the huge wealth of crop biodiversity created by farmers over millennia since the dawn of agriculture. Make no mistake — the crop diversity we collected from the 1960s to the 1980s was considered at that time by many farmers and extension officers to be inferior. They wanted the new miracle varieties that gave farmers the higher yields they needed to live without hunger. They stopped using their old low-yielding varieties. Without the foresight of our predecessors, much of this age-old biodiversity would now be extinct.

By conserving the old varieties, the CGIAR genebanks have done more than anyone else to ensure the sustainability of modern agriculture. New challenges confront us all the time: emerging strains of pests and diseases, modern concepts of breeding for nutrition and eating quality, and innovative technologies to make farming more efficient and environmentally benign. The genes required to meet these new challenges are largely found in the old varieties. If we had lost them, sustainable progress in agriculture would have become impossible.

Maintaining the sustainability of modern agriculture — and thereby alleviating poverty and banishing the specter of mass famine — requires us to exploit the old varieties. But this raises daunting questions. How can we exploit them fairly, with due respect for the rights of the farmers and others in the countries from which they came? Indeed, what are the rights of those farmers and countries?

These are hugely difficult and sensitive questions, beyond the authority of the CGIAR itself to answer. They are national and transnational political issues. The 1993 Convention on Biological Diversity declared that nations have sovereign rights but did not define the rights of farmers or a mechanism for fair exploitation of biodiversity. Each country needs to work out its own answers, through whatever consultation process its government uses.

Then there must be a process of intergovernmental discussion and negotiation to develop internationally agreed standards. The relevant intergovernmental body is the Commission on Genetic Resources for Food and Agriculture, which was formed in 1983 specifically to address these issues. Its 164 member countries together dictate how CGIAR genebanks manage, share and exploit their vast collections.

The new International Treaty on Plant Genetic Resources for Food and Agriculture implements, for the first time ever, an agreed mechanism for sharing the benefits arising from the exploitation of biodiversity

Through these countries, a momentous new treaty — the International Treaty on Plant Genetic Resources for Food and Agriculture — came into force on 29 June 2004 (see page 6). This treaty establishes, for the first time ever, an internationally agreed framework that recognizes the rights of the farmers and countries that developed the old varieties on which modern sustainable agriculture is based, and it implements an agreed mechanism for sharing the benefits arising from the exploitation of biodiversity.

As we have done regarding previous decisions of the commission, the CGIAR genebanks will adopt the policies and mechanisms of the new treaty. That is the only way we can be sure of following internationally agreed and acceptable standards.

If you disagree with these standards — if you think they cloak biopiracy in a mantle of respectability — what should you do? Well, don't complain about the CGIAR genebanks. There is nothing we can do about the standards because we do not decide national policies or international agreements. We merely implement them. Instead, lobby your relevant governmental department. Get it to consider alternatives. If it is not a member of the commission, get it to join. If it is not a party to the new international treaty, get it to join the governing body. That way, you and your government can contribute to new decisions that will affect and improve how we honor farmers' and countries' rights to share in the benefits of sustainable improvement in agriculture.

World Rice Research Conference

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4 November 2004
Akasaka Prince Hotel, Tokyo, Japan

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New technologies for rice production
Gurdev S. Khush, University of California, Davis

Lifestyle
The role of rice in the diet of Japan
Yoshiko Kagawa, Kagawa Nutrition University

Livelihood
The power of settlement
Ken-ichi Matsumoto, Reitaku University

Sustainability
The changing economics and politics of rice: Implications for food security, globalization and environmental sustainability
Joachim von Braun, International Food Policy Research Institute

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Feeding the world in the 21st century
Vaclav Smil, Manitoba University

Research strategy for rice in the 21st century
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