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Rice Today

International Rice Research Institute
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Celebrating 50 years of rice research in India

What kind of rice do consumers want?
Rice in Latin America on the world stage
Rice yield rises with WeRise

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RiceToday Vol. 14, No. 2

About the cover. Indian farmer Nekkanti Subba Rao holds part of his bumper crop of flood-tolerant Swarna-Sub1, which he harvested in 2009 on his Andhra Pradesh farm. He was also on the cover with the miracle rice IR8, in October 2006 to celebrate the 40th anniversaty of that variety's release. On pages 10-11, find out more about how this amazing pioneer, popularly known as *Dhaan Pandit* (rice expert), helped kick-start both the first and second Green Revolutions in India. (Photo by Manzoor Hussain Dar)

Rice Today is published by the International Rice Research Institute (IRRI) on behalf of the Global Rice Science Partnership (GRiSP).

IRRI is the world's leading international rice research and training center. Based in the Philippines and with offices located in major rice-growing countries, IRRI is an autonomous, nonprofit institution focused on improving the well-being of present and future generations of rice farmers and consumers, particularly those with low incomes, while preserving natural resources. It is one of the 15 nonprofit international research centers that are members of the CGIAR consortium (www.cgiar.org).

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Rice Today welcomes comments and suggestions from readers. The opinions expressed by columnists in *Rice Today* do not necessarily reflect the views of IRRI or GRiSP.

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Celebrating 50 years of impact through rice research in India

The Indian Council of Agricultural Research (ICAR) and the International Rice Research Institute (IRRI) are delighted to jointly observe 50 years of successful rice research in India. During 12-15 April 2015, around 400 Indian researchers will be holding the 50th Annual Rice Group Meeting of the All India Coordinated Rice Improvement Project in Hyderabad.

ICAR's Hyderabad-based Directorate of Rice Research (DRR), recently named the Indian Institute of Rice Research (IIRR), is also planning special events later this year to celebrate its half century of significant contributions toward ensuring food security for all Indians.

The India-IRRI partnership has been a fruitful synergistic relationship. IRRI has had a long tradition—since the 1960s—of tapping into the unique expertise of many prominent Indian scientists to guide its research, governance, and management. Over the years, more than 50 Indians have distinguishingly served—or are serving—IRRI as globally recruited staff and 17 have been decision makers as members of the Board of Trustees. Since 1964, many Indian scholars have studied at IRRI to earn advanced degrees or participate in other educational programs.

During IRRI's early days, Dilbagh S. Athwal, an Indian plant breeder, worked at various levels in IRRI's upper management for a decade during 1967-77, ultimately serving as the Institute's first deputy director general. Later, M.S. Swaminathan, the first World Food Prize Laureate in 1987, served as IRRI's fourth director general during 1982-88.

Indian scientists at IRRI have contributed significantly to IRRI's success in using cutting-edge science to help bring food security, economic growth, and environmental protection to the world through their dedicated research and administrative efforts. G.S. Khush, the celebrated rice breeder and 1996 World Food Prize Laureate, worked for 34 years at IRRI and made countless contributions to keep the Green Revolution in rice production on the right path, especially with his breeding team's development of landmark varieties IR36 and IR64. Other prominent Indian researchers, as international staff members at IRRI, have helped the Institute become what it is today. They are listed on the IRRI-India website**.**

For their part, ICAR and IIRR are particularly interested in South Asia-focused flagship projects related to climate change, resource management, rice varietal development, GM research, and capacity building.

ICAR and IIRR especially appreciate IRRI's initiative in setting up, in 2012, the South Asia Rice Breeding Research and Training Hub at the International Crops Research Institute for the Semi-Arid Tropics in Hyderabad. The hub is already providing targeted breeding and training in India with a spillover benefit to other countries in the region.

ICAR and IRRI are seeking new opportunities to increase India's focus on upstream and innovative research and to catalyze the transfer of the new technologies to the region's farmers and others in the value chain. In addition, the partnership is playing a major role in further developing the rice sector, particularly in eastern and southern India.

In this issue, on adjacent *Grains of truth*, pages 46-47, you can read more about the historic India-IRRI partnership from the perspectives of Dr. Swaminathan and J.K. Ladha, principal scientist and IRRI representative for India and Nepal. Also, find out on pages 10-11 why progressive Indian farmer-researcher Nekkanti Subba Rao, standing in the same field on his Andhra Pradesh farm, is featured on a second *Rice Today* cover.

On pages 16-18, Indian rice breeder extraordinaire E.A. Siddiq talks about his life's work in an exclusive IRRI pioneer interview. Dr. Siddiq developed semidwarf basmati varieties for the country's agricultural export trade and stiff-strawed varieties for India's now-thriving rice-wheat rotation. While on the IRRI Board of Trustees during the early 2000s, he fought for the continuation of the International Network for the Genetic Evaluation of Rice as well as hybrid rice research, which were on the budget-cut chopping block at the time.

Late last year, a cadre of renowned Indian rice scientists and administrators was asked to give testimonials on behalf of the thriving India-IRRI relationship. There was an enthusiastic response. Topics ranged from achievements in hybrid rice and building India's scientific capacity to addressing climate change. Read selected highlights of these tributes on pages 26-29 and see the full set on the *Rice Today* website.

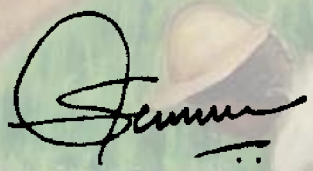
The centerfold features the panoramic mural of Indian rice farming mounted on the wall of the DRR's Rice Museum in Hyderabad. Commentary on what it signifies comes from B. Mishra, former DRR project director, who commissioned the work in 2005. This issue's map section on pages 38-39 provides an interesting assessment of the rice preferences of urban consumers in India and Bangladesh.

On pages 20-21, learn about the achievements of two Indian scientists far away from home working with the Africa Rice Center—systems agronomist Senthilkumar Kalimuthu and lowland rice breeder Venuprasad Ramaiah.

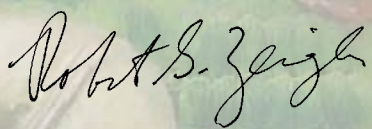
In his regular *Rice facts* column on pages 43-45, IRRI head economist Sam Mohanty discussess India reaching the pinnacle in rice exports.

So, while reflecting on the last 50 years, read and enjoy these features and others in this special India-focused issue of *Rice Today*!

In the meantime, as the directors general of our respective organizations, we pledge that ICAR-IRRI will continue the partnering spirit of the last five decades to involve our scientists in enhancing food security in not only India but in all of South Asia.



Subbanna Ayyappan
Director general
Indian Council of Agricultural Research (ICAR)
Secretary of the Department of Agricultural Research and Education (DARE), Ministry of Agriculture of India, and
Member, IRRI Board of Trustees (2013-15)



Robert S. Zeigler
Director general
International Rice Research Institute


AFRICARICE

Harold Roy-Macauley is new AfricaRice director general

Harold Roy-Macauley, a Sierra Leonean national, was appointed as the new Director General of the Africa Rice Center (AfricaRice) at an Extraordinary Session of the Council of Ministers of AfricaRice held on 6 February in Kampala, Uganda. Dr. Roy-Macauley has nearly 30 years of experience in agricultural research with extensive leadership and management expertise. He is currently the executive director of the West and Central African Council for Agricultural Research and Development (CORAF/WECARD)—a leading subregional organization that coordinates and facilitates agricultural R&D activities in 22 countries in West and Central Africa.

Dr. Roy-Macauley is no stranger to CGIAR, having served previously as the regional director for the World Agroforestry Centre in West and Central Africa. He has consulted for numerous international and bilateral organizations on biosafety and biotechnology and was the managing director for the Regional Center for Improving Adaptation to Drought in Senegal, a research and training center of CORAF/WECARD.

As part of his mandate at AfricaRice, he underlined the importance of "introducing more high-end life science and socioeconomic applications in the Rice Sector Development Hubs, convened by AfricaRice, to help consolidate the already profound and significant changes the rice value chain is undergoing in Africa."

Describing the 2011-2020 strategic plan of AfricaRice to boost the rice sector in Africa as "evidenced-based and therefore very solid and powerful," he urged AfricaRice staff "to be adventurous and ingenious in the way we roll out our rice science."

Dr. Roy-Macauley outlined his first priorities as:

- Rendering partnerships more efficient around rice science and sector development,
- Strengthening capacity for rice science and sector development,
- Improving access of smallholder rice producers to markets,
- Reintegrating rice science in the policy agenda of countries, and
- Increasing investments in rice science and sector development.

Source: http://africarice.org

AfricaRice agronomist wins France's Young Promising Scientist Prize

Kazuki Saito, Africa Rice Center (AfricaRice) agronomist from Japan, was awarded the Agropolis Foundation's Louis Malassis Young Promising Scientist Prize for his exemplary and promising contributions in the field of agriculture and food. Dr. Saito (second from right) is the driving force behind the Rice Agronomy Task Force, convened by AfricaRice, which is conducting activities in 21 countries across Africa. Yield-gap survey protocols for the Agronomy Task Force, developed under Dr. Saito's leadership, are currently being used in these countries by national research institutions in sub-Saharan Africa.

The results from the surveys are enabling AfricaRice and its partners to identify the opportunities available to introduce technologies to close yield gaps. (See *A game changer in Africa's rice agronomy* on pages 34-35 of *Rice Today* Vol. 13, No.3)

Source: http://africarice.blogspot.com


AFRICARICE

California rice farmer uses the market to protect wildlife and boost profits

A project on Knaggs Ranch in California's Central Valley is helping to keep water on the fields during a time and at a volume critical to support salmon nurseries while providing beneficial habitat for water fowl and shore birds. "Farmers are environmentalists, too," says John Brennan, a farm manager for the ranch. "Programs like this will help us fulfill our responsibility to nature and to coming generations."

By adjusting land management to benefit such species, Mr. Brennan is generating conservation outcomes that he hopes can be sold as a commodity to private and public investors through the Central Valley Habitat Exchange. Potential investors include state agencies seeking credits to meet mitigation requirements or restoration mandates.

Source: http://www.edf.org

Vietnam plans to have national brand name for rice

The Ministry of Agriculture and Rural Development has submitted a plan to the government that seeks to develop a Vietnamese rice brand name by 2020. Vietnam has been one of the top three rice-exporting nations but it lacks brand names that are known in the global market, the ministry said in its proposal. Around 90% of the country's rice exports comes from the Mekong Delta. Last year, delta provinces exported 3.2 million tons of high-quality rice, accounting for 52% of total exports, and 44% higher than in 2013. Customers in the Europe, North America, Asia, and Africa have increased import of Vietnamese rice thanks to good marketing. But the ministry points out that Vietnamese rice varieties face challenges when trying to enter quality-conscious markets.

Source: http://vietnamnews.vn

IRRI

Basmati rice exports to Iran likely to resume

IRRI

After several rounds of discussions, Iran is likely to start issuing permits to Indian exporters, paving the way for basmati exports. "India may resume exports of basmati rice exports to Iran early next year," said Ajay Sahai, director general of the Federation of Indian Export Organisations.

Basmati rice exports from India in 2013-14 were predicted to decline by 10% due to Iran's temporary stoppage of fresh order issuances. The country has not issued any fresh import permits after October 2014 due to oversupply. However, execution of existing and past orders has continued.

"India does not face any ban in terms of basmati rice exports to Iran. During past years, Iran had imported a large quantity of basmati rice from India," said A.K. Gupta, director, Agricultural and Processed Food Products Export Development Authority.

Source: http://www.business-standard.com

Three-year field trials with nitrogen-efficient rice show significant yield increases

Arcadia Biosciences Inc., an agricultural technology company that develops and commercializes plant traits and products that improve farm economics and benefit the environment and human health, has joined with the International Center for Tropical Agriculture (CIAT).

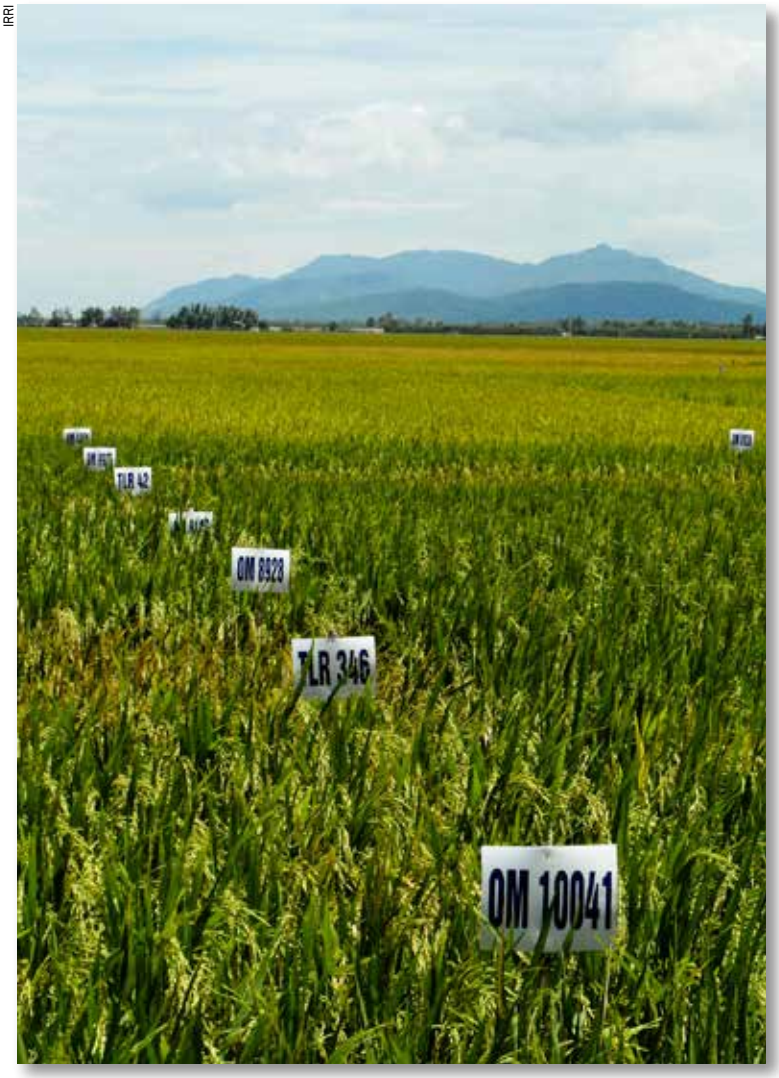
They have jointly announced the completion of a third year of field trials of nitrogen-use efficient (NUE) rice. CIAT has been testing the rice at the Center's research fields in Colombia. For the third year in a row, rice lines with Arcadia's NUE trait produced significant yield increases relative to conventional varieties.

CIAT

Over the 3 years of field trials, the leading rice line with Arcadia's NUE trait out-yielded control lines by an average of 27%. The trials included both irrigated lowland and rainfed upland locations. In the third year trial at 50% of normal applied nitrogen fertilizer, the leading NUE rice line out-produced the control line by 33%. The previous two years' trials showed yield increases of 22 and 30%, respectively.

Source: http://www.pharmiweb.com

IRRI



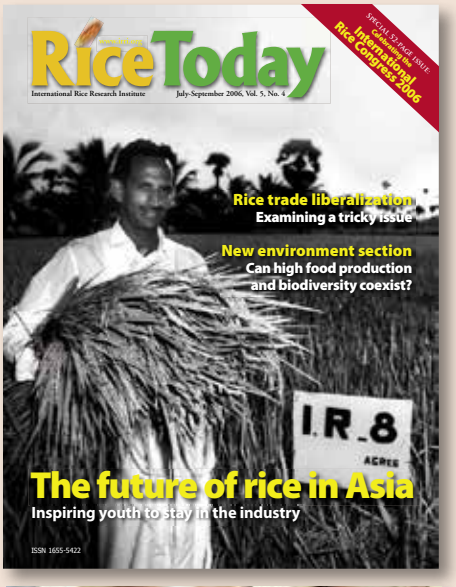
Vietnam plans greener rice cultivation

Vietnam plans to reduce greenhouse gas emissions from rice cultivation by 14% by 2030, according to the Ministry of Natural Resources and Environment. Pham Hoang Yen, an expert involved in the United Nations Framework Convention on Climate Change (UNFCC) and the Kyoto Protocol, said that, in the last few years, the country had chased the goal of a 20% reduction in greenhouse gasses (GHG) in the overall cultivation sector by 2020.

What the country has been doing includes preparation for National Appropriate Mitigation Action and other policies developing countries adopted to control global GHG at a UNFCC conference in Bali 8 years ago.

Vietnam has also carried out a program of Clean Development Mechanism (CDM). In June last year, the country had 253 CDM projects and had registered 11 programs of activities. This move earned it 10.7 million certified emission reduction credits granted by the CDM Executive Board through CDM activities, Mr. Yen said. The total GHG emissions reduction from the 253 CDM projects was 137 million tons of carbon dioxide equivalent.

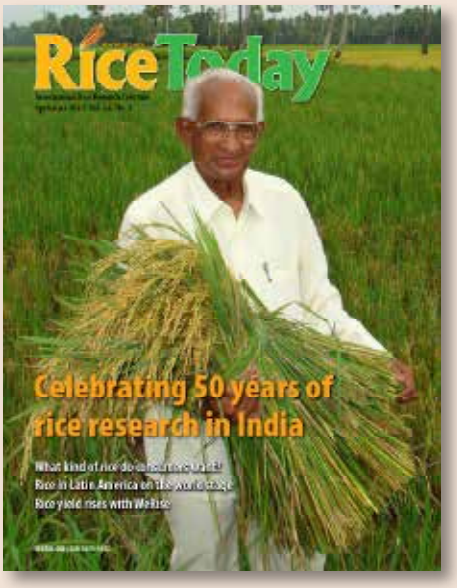
Source: http://english.vietnamnet.vn



Rice Today coverage on India over the years

India is one of the world's largest rice-producing and -consuming countries, not to mention one of IRRI's most important partners in rice research.

So, since *Rice Today* began publishing in 2002, we have provided a cornucopia of coverage on India—several covers and more than 40 stories and features on a range of topics important to Indian farmers and consumers. See the listing and links to those stories at www.irri.org/rice-today/india.



IRRI TRAINING CALENDAR 2015

Course title	Date	Application deadline
Effective Presentation Skills Workshop	28 July	28 May
Training Workshop on Rice Technology Transfer Systems in Asia	7-20 June	6 April
Rice: Research to Production	10-28 August	25 June
Research Data Management	8 September	8 July
Effective Presentation Skills Workshop	28 September-9 October	28 July
Molecular Breeding Course	12-23 October	12 August
Rice: Postproduction to Market (2nd offering)	27-29 October	27 August
Basics of Rice Production (2nd offering)	2-13 November	27 August
Ecological Management of Rodents, Insects, and Weeds, in Rice Agroecosystems	9-13 November	2 September
Basic Scientific Writing Course	9-13 November	9 September
Advanced Applications of ORYZA V3 in Rice Research	9-13 November	9 September
Research Data Management	24-26 November	24 September
Effective Presentation Skills Workshop	3 December	3 October

For inquiries, contact IRRITraining@irri.org, m.maghuyop@irri.org, or a.aquino@irri.org. Phone: (63-2) 580-5600 ext 2538 or +639178639317; fax: (63-2) 580-5699, 891-1292, or 845-0606; mailing address: The IRRI Training Center, DAPO Box 7777, Metro Manila, Philippines (Attention: TC Course Coordinator); Web site: www.training.irri.org.
Note: Fees and schedules are subject to change without prior notice.

RiceToday around the world

IN EARLY February, Robert Zeigler, director general of the ▲ International Rice Research Institute (IRRI; *center 2nd row with Rice Today*), interacted with rice-farming families in northeastern Thailand near Ubon Ratchathani. This was an area where he spent significant time more than 20 years ago when he was the leader of IRRI's Rainfed Lowland Rice Ecosystem Program. His objective was to help improve rice production and the livelihoods of farmers trying to make a living under the region's harsh rainfed conditions. His prognosis after the 2-day visit: "I'm very happy with what I've seen and heard. A lot of progress has been made."

IN LATE January, IRRI's Appslab Team, the people behind ▶ the Rice Crop Manager app., visited Batad Village in Banaue, Ifugao, Philippines. This location is a UNESCO Heritage Site featuring the spectacular Amphitheater Rice Terraces. From left to right are Apol Banasihan, Carlo Liwanag, Prime Sazon, Terry Velasco, Erica Banasihan, Weng Castillo, PJ Sinohin, Edsel Moscoso, Apple Suplido, and Jecjec Dela Torre.

SAFARI WITH *Rice Today*. Jedd Dumaguina, sound recordist and photographer for Monoxide Works, poses with *Rice Today* in a four-wheel-drive vehicle during a safari in Masai Mara National Reserve in Kenya. The Masai Mara, one of the best known wildlife reserves in Africa, is very popular with tourists, travel writers, documentary makers, and researchers.

Indian farmer kick-starts two GREEN REVOLUTIONS

IRRI ARCHIVES

MANZOOR HUSSAIN DAR, IRRI

NEKKANTI SUBBA RAO helped kick-start both the first and second Green Revolutions in India by promoting and distributing IR8 in 1967 and Swarna-Sub1 in 2009.

by **Gene Hettel**

A while back, I read an interesting story extolling the merits of the new flood-tolerant rice, Swarna-Sub1, in the newsletter of the Stress-Tolerant Rice for Africa and South Asia (STRASA) project. The author, Manzoor Hussain Dar, International Rice Research Institute (IRRI) senior associate scientist based in India, included two photos of the same farmer, Nekkanti Subba Rao, in the same field on his Andhra Pradesh farm.

Spanning two Green Revolutions

I found this striking because the photos had been taken 42 years apart! One depicted a young 29-year-old farmer in 1967 clutching a bundle of lush grain-laden panicles of IR8, the rice variety that started the first Green Revolution (GR1.0) in the 1960s. The other showed a wizened 71-year-old in 2009, still with a twinkle in his eyes and the same bright smile, in a similar pose.

However, this time, Mr. Subba Rao was grasping a bundle of panicles of Swarna-Sub1, a popular variety (Swarna) made flood-tolerant by incorporating the *SUB1* gene. Many have since considered Swarna-Sub1 and other popular varieties with a *SUB1* background to be the launching pad for the second Green Revolution (GR2.0), which is being publicized to leave no poor farmer behind (see *Green Revolutions 2.0 & 3.0: No farmer left behind* on pages 32-35 of *Rice Today*, Vol. 14, No. 2).

Well, the *Rice Today* staff needed to look no further for a cover photo subject to grace this issue, which is celebrating 50 years of rice research in India. It was an easy decision. The 1967 photo was on the cover of our October-December 2006 issue to observe the 40th anniversary of the release of IR8 in Asia.

Mr. Subba Rao's farming livelihood and his on-farm research have spanned the same period. During this time, he has continuously collaborated with the All India Coordinated Rice Improvement Project in testing new varieties, producing certified seeds, and establishing beneficial links between scientists and farmers. Truly, this has made him an integral part of the history of the Green Revolutions in India.

Testing and distributing IR8 and Swarna-Sub1

He proudly recalled that, in 1966, he was one of the first farmers to plant Taichung-Native 1 (TN1) for national demonstrations. TN1 was actually the first indica rice variety carrying the semidwarfing gene, *sd1,* derived from Taiwanese variety Dee-geo-woo-gen, which is also a parent of IR8. However, IR8 and subsequent IRRI varieties proved to be more disease resistant and quickly replaced TN1.

In 1967, Mr. Subba Rao tested IR8 on his farm and supervised its first large-scale demonstration and multiplication—on about 2,000 hectares near his home village of Atchanta—following instructions from the government of India. The next year, IR8 was planted on 1,600 hectares in his village and the rest was history, with the seeds soon being distributed throughout the country. So, in addition to being called *Dhaan Pandit* (rice expert) by his neighbors, he is also known by the moniker "Mr. IR8," which still resonates with many Indian farmers to this day.

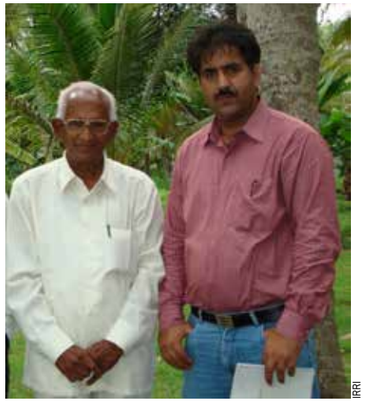
Dr. Dar, who coordinates research and seed upscaling and dissemination-related activities for STRASA in stress-prone rainfed lowlands in South Asia, has had the privilege of working with this pioneer farmer for the last 6 years. "Mr. Subba Rao has been instrumental in promoting and distributing Swarna-Sub1," he says. "In fact, in 1979, he grew, tested, and inspired his neighboring farmers to grow the original Swarna, even before it was officially released, because of its high-yielding and good eating qualities. After its release, Swarna covered the entire Godavari Belt in India and continues to be the variety of choice among millions of farmers in India and neighboring countries."

Unfortunately, Swarna yields often decrease during seasons with lots of flooding. So, Mr. Subba Rao was especially excited when IRRI breeders incorporated the *SUB1* gene into Swarna. It was a dream come true.

Says Dr. Dar: "Mr. Subba Rao evaluated Swarna and Swarna-Sub1 side by side in his field and invited hundreds of farmers to come see the difference. Luckily, for observational purposes, the seedlings got submerged that season and Swarna-Sub1 performed so much better than Swarna. He distributed Swarna-Sub1 seed from his 2008 kharif harvest to other farmers, who multiplied it during the rabi season 2008-09. This resulted in the spread of Swarna-Sub1 to nearly 1,000 hectares during the 2009 kharif season in a dozen surrounding villages."

JEC NARCISO, IRRI

IN THE IRRI fields during his 2014 visit, "Mr. IR8" visits a demonstration plot of rice variety IR8, which launched GR1.0.



IRRI

MR. SUBBA RAO and Dr. Dar confer often on the latest available technologies that may benefit the farmers of the region.

A farmer-scientist

"In 2012, I gave him 1 kilogram of seed of Ciherang-Sub1, a short-duration, flood-tolerant variety with high grain quality," says Dr. Dar. "Not surprisingly, he multiplied it in the kharif and also cultivated it during the following boro season. It had higher yield than other popular rabi rice varieties and thus spread through hundreds of hectares in a few years and has become a popular variety. Through the local university, he has also helped distribute 1,000 mini-kits of Ciherang-Sub1 to the farmers before its release. That's how he works.

"I consider Mr. Subba Rao a scientist himself," says Dr. Dar. "He is truly an inspiration to the farmers in the area and has a large following. He is the best promoter around of the new technologies and he creates a lot of awareness among the farmers."

No stranger to IRRI

In 1985, during IRRI's 25th anniversary, the Institute organized a multilevel symposium that included scientists, political leaders, and—most importantly—14 outstanding farmers identified from 10 nations. Two Indians were in that group to visit the Philippines, Sardar Jagjit Singh Hara from the Punjab (see *In the Punjab: an outstanding farmer revisited* on pages 34-35 of *Rice Today*, Vol. 8, No. 2) and Andhra Pradesh's own Dhaan Pandit! Mr. Subba Rao and his fellow outstanding farmers generously shared their experiences with IRRI scientists and scholars during that event. He was part of the group because he was already averaging 8 tons per hectare on his 10-hectare farm back then in the mid-1980s.

ISAGANI SERRANO, IRRI

MR. SUBBA RAO speaks during IRRI's 2014 Farmers' Day.

"Science has a great role to play in helping farmers because the cost of cultivation continues to increase and outbreaks of insect pests and diseases result in severe losses," he said to the participants during the 1985 symposium. He added that community participation and proper government policies could significantly influence returns.

Flash forward 29 years to 1 October 2014. Mr. "IR8" was back at IRRI Headquarters in the Philippines to mingle with more than 400 Filipino farmers during the Institute's *Araw ng Magsasaka sa IRRI* (IRRI's Annual Farmers' Day). He repeated his 1985 message to a new attentive audience by sharing his experiences, practices, and insights. It is clear that he brims with pride about his role in helping usher in both GR1.0 with IR8 and GR2.0 with Swarna-Sub1 and the even better varieties that are following.

"He is always excited about innovative varieties and technologies," concluded Dr. Dar. "I wish I had a new product to give him every year because, through his network, we can best bestow maximum benefits to the thousands of farmers in the region."

Mr. Hettel is editor-in-chief of Rice Today *and IRRI historian.*

India-IRRI timeline spans the **decades**

Over the last five decades, this selection from IRRI's historical timeline (online at www.irri.org/about-us/our-history) has many Indian connections tied to people and events.

Compiled by **Gene Hettel**
Photos from **IRRI archives**

1965

The **Indian Council of Agricultural Research (ICAR)** established the **All India Coordinated Rice Improvement Project (AICRIP)** in Hyderabad. Indian breeder **S.V.S. Shastry** (right in photo) and **Wayne Freeman**, IRRI's representative in India, were designated as the first joint coordinators.

Benjamin Pearey Pal became the first director general of **ICAR**. He later served as an early member of IRRI's board of trustees (1967-70).

1967

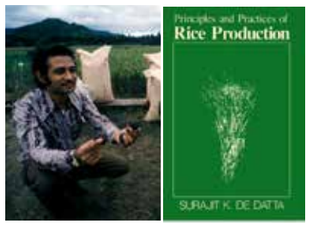
Indian plant breeder **Dilbagh S. Athwal** joined IRRI's management team and ultimately served as the Institute's first deputy director general.

Andhra Pradesh farmer **Nekkanti Subba Rao** tested IR8 on his farm and supervised its first large-scale demonstration and multiplication.

The India-IRRI partnership intensified when scientists from **AICRIP** and the **Central Rice Research Institute** in Cuttack began to visit IRRI headquarters in the Philippines. This led to the first formal memorandum of understanding for cooperation in research and training signed by **ICAR** and IRRI in **1974.**

1968

After threshing his first full harvest of IR8 resulting in a bumper rice crop, Indian farmer **K.N. Ganesan** saw that this variety, which ushered in the Green Revolution, would be changing his family's future. He was so impressed with the variety's performance that he named his second son, born that same day, IR8–IR-ettu (Irettu) in Tamil.



1981

The seminal book, ***Principles and practices of rice production***, by IRRI agronomist and principal scientist **S.K. De Datta**, was published by John Wiley and Sons, Inc. It was the model for many future IRRI books picked up by reputable science publishers. In **1986**, Dr. De Datta received the first **International Soil Science Award** from the **Soil Science Society of America**.

1982

M.S. Swaminathan became IRRI's fourth director general. He later won numerous honors and awards. In **1987**, Swaminathan Hall at IRRI headquarters was dedicated in his honor. In **1991,** he won the **John and Alice Tyler Prize for Environmental Achievement** and the **Honda Prize**. In **1999**, he was named among the 20 most influential Asians of the 20th century by *Time* magazine.

1986

Amir U. Khan (right), IRRI agricultural engineer, received the **International Inventor's Award for Industry** from Sweden's **King Carl Gustaf** during ceremonies held in Stockholm. The award recognized his contributions to the farm machinery industry in developing countries such as the axial flow thresher.

1996

G.S. Khush, IRRI principal plant breeder, won the **World Food Prize**, with **H.M. Beachell**, former IRRI plant breeder. He has also won the **Rank Prize for Nutrition** in London (**1998**) and the **Wolf Prize in Agriculture** (**2000**). In **2002**, in recognition of his 29 years as head of IRRI's Plant Breeding, Genetics, and Biotechnology Division and leader of various research programs, the Collaborators' Center building was renamed Gurdev S. Khush Hall.

The week-long ***3rd International Hybrid Rice Symposium*** was held in Hyderabad.

2002

ICAR hosted the first steering committee meeting of the **Consortium for Unfavorable Rice Environments (CURE)** in New Delhi, India.

Sant Virmani, IRRI plant breeder, was elected as a **fellow of the American Association for the Advancement of Science** and received the **International Service in Crop Science Award** from the **Crop Science Society of America**. In **2005**, he received India's **Pravasi Bharatiya Samman Award** and Japan's **International Koshihikari Rice Prize**.

J.K. Ladha, IRRI soil nutritionist, was named a **fellow of the American Society of Agronomy**. Other recognition he has received includes: **fellow of the Soil Science Society of America** (**2004**), **fellow of the American Association for the Advancement of Science** (**2009**), and the **International Service in Agronomy Award** from the **American Society of Agronomy** (**2011**).

2003

In New Delhi, the achievements of agronomist **Virendra Pal Singh** were recognized as he departed IRRI after serving the Institute for 30 years where he worked to improve the rice-farming systems in unfavorable environments.

IRRI agronomist **Vethaiya Balasubramanian** received the **International Fertilizer Industry Association International Award.**

2006

His Excellency **A.P.J. Abdul Kalam** (center), president of the Republic of India, and party visited IRRI Headquarters. He interacted with staff scientists, seeking solutions to problems faced by Indian farmers.

The ***2nd International Rice Congress*** in New Delhi attracted nearly 1,400 rice researchers, traders, millers, farmers, and agriculture ministers, including 400 delegates from 46 countries.

2007

Darshan Brar, head of IRRI's Plant Breeding, Genetics, and Biotechnology Division, won the **Koshihikari International Rice Prize,** recognizing his rice research body of work. He also received the **CGIAR Outstanding Scientist Award,** honoring his original work that furthered CGIAR goals.

2008

More than 40 years after his work with IR8, Mr. **Subba Rao** distributed seed from his harvest of flood-tolerant Swarna-Sub1 to other farmers who multiplied it, ultimately leading to the significant spread of the variety in the region.

In New Delhi. the South Asian wing of the project, **Stress-tolerant rice for Africa and South Asia (STRASA)**, was inaugurated.

2009

An international agreement was signed between **ICAR** and IRRI to support and facilitate India's rice research, helping the nation's rice production at a time of unprecedented price volatility and subsequent need for revitalization of food production.

The **Cereal Systems Initiative for South Asia (CSISA)** was established to promote durable change at scale in the region's cereal-based cropping systems. **CSISA India**'s activities focus on areas of the eastern Indo-Gangetic Plains dominated by small farm sizes, low incomes and comparatively low levels of agricultural mechanization, irrigation, and productivity.

2011

The **Sardar Vallabhbhai Patel University of Agriculture and Technology** in Meerut honored IRRI Director General **Robert Zeigler** by naming its new soil- and plant-testing laboratory after him. He was also conferred with the honorary degree of doctor of science by the **Govind Ballabh Pant University of Agriculture and Technology** in Pantnagar. In **2014** (photo), he was conferred with an honorary degree of doctor of science during the 35th convocation ceremony of **Tamil Nadu Agricultural University** in Coimbatore.

Sam Mohanty, IRRI economist and Social Sciences Division head, won the prestigious **Glory of India Award** in New Delhi.

2012

The project, **Improved Rice-based Rainfed Agricultural Systems in Bihar**, was launched in India by the **Catholic Relief Services** and IRRI. Supported by the Bill & Melinda Gates Foundation, it targets drought- and flood-prone environments.

Dr. **Zeigler** inaugurated new and added office space for the IRRI India Office in New Delhi located at Rajendra Place.

The **IRRI South Asia Rice Breeding Hub** at the **International Crops Research Institute for the Semi-Arid Tropics** (**ICRISAT**) in Hyderabad, India, was inaugurated by Dr. **Zeigler** and Dr. **William Dar,** director general of ICRISAT (middle photo).

The ***6th International Hybrid Rice Symposium*** was held in Hyderabad.

Ashish Bahuguna (left in photo with Dr. **Zeigler**), secretary of the Ministry of Agriculture and Cooperation, Government of India, signed a memorandum of agreement with IRRI to further strengthen IRRI's collaboration with India.

The global rice research agenda was the focus of a plenary talk given by Dr. **Zeigler** during the ***Third International Agronomy Congress*** held at the **Indian Agricultural Research Institute** in New Delhi.

In his **Coromandel lecture**, ***Cutting-Edge Rice Science for Food Security, Economic Growth, and Environmental Protection in India and Around the World***, Dr. **Zeigler** noted that IRRI and India have been working together since the mid-1960s to develop and deliver ways to help Indian rice farmers improve their rice productivity.

2013

Coromandel International Limited signed a memorandum of understanding with IRRI for cooperation in promoting and disseminating improved rice research technologies in India.

As part of the 2013-16 IRRI-India Work Plan, the Institute and the **Tamil Nadu Agricultural University** signed a memorandum of understanding to promote research, training, and exchange of information and technology on rice and its farming systems and value chains.

Bayer CropScience, IRRI, and **ICAR** sponsored an inaugural 2-day ***Rice Future Forum*** in New Delhi. **Bas Bouman**, director of **Global Rice Science Partnership**, was one of the presenters.

Senior officials from **India's Ministry of Agriculture** visited IRRI for a 2-day series of awareness and consultation meetings, particularly to discuss **STRASA**.

2015

In its Golden Jubilee year, the **Directorate of Rice Research** in Hyderabad is given national institute status under the **ICAR** umbrella. It is now the **Indian Institute of Rice Research**. It has been IRRI's privilege to have worked, trained, and learned together with Indian scientists over 5 decades to help improve the lot of rice farmers and to help feed the world's hungry.

Regional cooperation speeds up the release of rice varieties

by **Lanie Reyes**

Rice farmers in India, Bangladesh, and Nepal will have faster access to newly developed high-yielding climate-smart varieties. This is thanks to an unprecedented regional seed cooperation agreement that speeds up the release and dissemination of rice varieties to benefit farmers in the region.

Saves breeding time

The regional seed cooperation saves a lot of resources and the time required for a variety to be released in one country. The time it takes from initial evaluation of a breeding line to the release of a new variety could take between 3 to 6 years.

"With this seed cooperation agreement, a rice variety that has been tested, approved, and released in one country can be released in other countries without undergoing further testing and evaluation, as long as they will be grown in similar agroclimatic conditions," says Abdelbagi Ismail, principal scientist at the International Rice Research Institute (IRRI). "The regional cooperation system is the most suitable platform for the three countries because they share similar agroecosystems and borders."

How it all started

"IRRI played a catalytic role to make the regional cooperation happen," says Dr. Ismail, who also leads the Stress-Tolerant Rice for Africa and South Asia (STRASA) project. "The Institute convened the senior officials of the three countries through a meeting under STRASA."

The regional seed cooperation started when delegations from India and Bangladesh met in February 2013. The delegation from India was headed by Ashish Bahuguna, secretary of agriculture and international cooperation of the Ministry of Agriculture; Matia Chowdhury, minister of agriculture, headed the Bangladeshi delegation, among other respective relevant agencies, including Monzur Hossain, secretary of agriculture. From IRRI, the delegation was headed by V. Bruce J. Tolentino, IRRI deputy director general for communication and partnerships.

Among other things, the two countries agreed to have a joint evaluation of improved rice varieties for release in areas with similar agroclimatic conditions in both countries. Part of that agreement provided for reciprocal acceptance of research data, including results of farmers' participatory varietal selection activities that are generated in one country to support varietal release in the other country.

And, consistent with the goal of bringing the needed climate-change-ready varieties to farmers in the shortest time possible, the two countries agreed on the promotion of prerelease multiplication and demonstration of breeding lines and varieties at advanced stages of release to fast-track awareness among farmers and to ensure a sufficient supply of breeder seed once a variety was released. In relation to this, the two countries agreed to work together in formulating seed protocols and guidelines that are compatible across countries.

On 18 October 2014, Nepal joined with the governments of Bangladesh and India to sign a protocol on regional seed cooperation in a workshop on seed issues held in Kathmandu, Nepal.

A historic moment

This regional cooperation on rice varieties among the three countries was declared historically significant by the agriculture executives.

Dr. S.M. Nazmul Islam, agriculture secretary of Bangladesh, believes that signing of this regional agreement ushers in a new era of collaboration and cooperation that aims to help improve the livelihood of the poor farmers in the region.

Nepal's agriculture secretary, Jaya Mukunda Khanal, shares the same view. "The cooperation has opportunities and options to improve the livelihood of poor farmers in the region," he says. "It will provide a platform to share good practices among countries and the exchange of technologies and quality seed can help attain higher rice productivity in the region."

Mr. Bahuguna notes that, although the agreement covers only rice, it can be extended to other crops later on. "This cooperation is not limited to the seed sector and will lead to agricultural development in the region," Mr. Bahuguna adds. For him, this cooperation can be expanded and replicated to other parts of the world. "The South Asian Association for Regional Cooperation can play a vital role in bringing in more countries to the platform."

Results to boot

The regional cooperation, even in its infant stage, has produced concrete results and has demonstrated what can be achieved. In fact, several varieties released in one country are already popular in another. "For example, BR11, BRRI dhan 28, and BRRI dhan 29, which are modern high-yielding rice varieties released in Bangladesh, are now widely grown in eastern India," reports Mr. Bahuguna.

Indian varieties are now estimated to be planted on more than 21% of the rice area in Bangladesh. Some Indian rice varieties, such as Swarna, Sarju 52, and Samba Mahsuri, are now popular in Nepal.

As the initial implementation step of this agreement by India, several varieties released in Bangladesh, such as BINA dhan 8, 10, 11, and 12, are recently notified for release in the Indian states of West Bengal, Assam, and Odisha. These varieties will be evaluated for release in other states also, but only for a year—as provided in the agreement.

Sukha dhan 5 and 6, drought-tolerant varieties released in Nepal, are being considered for release in Uttar Pradesh and Bihar.

The Indian government has been proactive in carrying out the regional cooperation agreement. In fact, starting in 2015, the Department of Agriculture of India allotted 30% of its funds to programs such as the National Food Security Mission (NFSM) and Bringing Green Revolution in Eastern India (BGREI) to further promote climate-smart rice developed by STRASA.

According to Dr. Ismail, the regional seed cooperation was carried out smoothly not only because these three countries share similar guidelines for varietal evaluation and release, but because each country shares a similar goal—that is, delivering the technologies needed by farmers.

Indeed, the success of the creation and the implementation of this regional seed cooperation clearly demonstrate that partnerships and collaboration can accomplish the goals very rapidly. It is hoped that, with IRRI's catalytic role and being a lead institute of the Global Rice Science Partnership, more milestones can be achieved among the partners. In the future, this kind of regional cooperation could help partners use resources efficiently as countries share relevant information with one another.

INDIA, BANGLADESH, Nepal, and IRRI seal the deal. From left, S.M. Nazmul Islam, Bangladesh; Robert Zeigler, IRRI director general; Jaya Mukunda Khanal, Nepal; and Ashish Bahuguna, India.

STRASA-BANGLADESH

WORKING TOGETHER (*from left*) India's Ashish Bahuguna and Bangladesh's Matia Chowdhury and Monzur Hossain.

Ms. Reyes is the managing editor of Rice Today.

A schoolboy at heart: Celebrated Indian scientist speaks his mind

The legendary Ebrahimali Abubacker Siddiq, 78, began his long and enduring rice research career in 1968 as a cytogeneticist at the Indian Agricultural Research Institute (IARI) in New Delhi, including 7 years there as a senior scientist. In 1983-86, he spent 3 years as a breeder for the International Rice Research Institute (IRRI) in Egypt. Returning to IARI, he was appointed professor of genetics (1986-87).

In late 1987, he became project director at the Directorate of Rice Research (DRR). In 1994, he assumed the position of deputy director general (crop science) of the Indian Council of Agricultural Research (ICAR). In 2000-05, he served as a member of the Institute's Board of Trustees from 2000 to 2005. His 35 years of research in plant breeding contributed to the development and release of high-yielding semidwarf basmati and nonbasmati varieties, which have boosted rice production in India.

Upon retirement from his regular ICAR service in 1997, ICAR named him a national professor (1997-2002). In 2002, he joined the Centre for DNA Fingerprinting and Diagnostics of the Department of Biotechnology, in which he served as the Distinguished Chair until 2007, when he continued there as an adjunct scientist. He is also an adjunct professor at the University of Hyderabad and IARI and is an honorary professor of biotechnology at Acharya NG Ranga Agricultural University in Hyderabad.

Here are some excerpts from his pioneer interview conducted in April 2014 in Hyderabad.

A long association with IRRI

My professional association with IRRI started in 1968. When I was a rice breeder at IARI, IRRI provided me opportunities to participate in its international symposia and conferences. Starting in 1987, as project director of DRR, my association with IRRI became even closer. As project director (1987-94), I progressively strengthened the relationship between India and IRRI.

My roles as a scientist, project director, deputy director general (crop science) at ICAR, and later as a member of IRRI's Board of Trustees enabled me to know and discover what India could gain through collaborative activities with IRRI, particularly in germplasm exchange and human resource development on all aspects of rice science.

Rewarding stint for IRRI in Egypt

When I was a senior scientist at IARI, IRRI, with M.S. Swaminathan as its director general, was keen to develop rice research in Egypt. I was chosen to be the rice breeder to join the USAID-supported project for establishing the National Rice Research and Training Institute. In 1983, I joined the project, which was technically coordinated by the University of California-Davis, and contributed to shaping and strengthening Egypt's rice breeding program.

Overall, the project team did a lot of good by streamlining research, training local scientists, and helping many get their PhD degrees. That 3-year exposure was really a wonderful experience personally for me and I feel, even today, that I achieved all that was expected of me as a breeder there.

Critical issues while on the IRRI Board

Keeping INGER. While serving on the IRRI Board, there were several issues I was concerned about during the early 2000s when Ronald Cantrell was Institute's director general. It was a time when funding support from major donor sources to CGIAR institutes, including IRRI, was declining. To cope with the situation, IRRI was contemplating projects and programs which should be continued and which ones might be pruned. Whether IRRI should continue or not with the International Network for the Genetic Evaluation of Rice (INGER) was one of the issues before the Board for a decision.

I impressed upon fellow board members that it was INGER that provided IRRI with true visibility in the rice world. Connecting almost

all rice-growing countries through international testing and exchange of germplasm, it was INGER that enabled rice-growing countries to strengthen their rice breeding research and develop varieties suited to their own different ecosystems. I emphatically said, don't prune INGER because what you are spending on it is not that much but what you gain is much more. Luckily, I and other INGER proponents on the Board won out and INGER thrives today.

Into Africa. Except for the limited INGER testing program, IRRI was not doing anything substantial for Africa. The Africa Rice Center (AfricaRice, formerly WARDA) was there addressing rice production constraints. Even so, given the large underexploited potential in Africa, I and other board members insisted that IRRI should emphasize and focus on improving rice productivity and production on the continent. So, the Board urged IRRI to give needed emphasis to Africa. That is when the first African national—Angeline Kamba—became the chair of the IRRI Board and when IRRI started to send more scientific staff to the continent to strengthen rice research there.

Focusing on the rainfed lowlands. Throughout my time on the Board, I insisted that IRRI should also focus on rainfed ecosystems, particularly the rainfed lowlands, where drought and submergence are major constraints. Although not so prominent in many Southeast Asian countries, this ecosystem constitutes a large area in South Asia, particularly in eastern India and Bangladesh. We cannot rely indefinitely on the irrigated ecosystem alone to meet our future rice demands. There has to be a balance across the irrigated and rainfed ecosystems. I am happy that India and IRRI are working together to address this issue through the development and adoption of submergence- and drought-tolerant rice varieties in eastern India through the Stress-Tolerant Rice for Africa and South Asia (STRASA) project.

Don't cut hybrid rice. There was a feeling that, unlike in China, hybrid rice research at IRRI was not making the expected level of progress. So, the issue came up before the Board if it were justified to prune the hybrid breeding program. I urged that the hybrid rice program be further strengthened, not pruned, because it is the only technology available with proven capability to raise the genetic yield ceiling. Even though it probably would not reach the levels achieved in China, certainly India and a few other countries in the region could gain from the technology in the coming years. I pleaded with the Board not to curtail ongoing support for hybrid rice research. The suggestion was accepted broadly and so the hybrid rice program at IRRI continues today.

I understand that today around 2.4 million hectares are being planted to hybrid rice in India. If our breeders come up with hybrids that can satisfy both farmers and consumers with appropriate growth duration, resistance to insect pests and diseases, and high grain quality, I am optimistic that, 3 or 4 years from now, Indian farmers should be planting 5 million hectares of hybrid rice. And even with a relatively small hybrid area, India is second only to China in bringing hybrid rice to farmers' fields.

A career achievement with basmati rice

My major work as a breeder was to develop high-yielding varieties with basmati quality. The unique quality characteristic of basmati rice is a complex genetic trait. Nearly all the physicochemical properties of starch are not simply inherited. Combining all the quality features of traditional basmati in a high-yielding background, therefore, was not an easy task.

At one stage of the breeding process, some people commented, "You are working for so many years; still, you're not coming out with high-yielding basmati varieties." While visiting the field, one critic sarcastically asked, "Should we bring in Norman Borlaug (the father of the Green Revolution) to develop the kind of basmati rice you are trying to achieve for so long?"

I was hurt by this remark and was compelled to respond that, with all respect to Norman Borlaug, I told him in the presence of many that you can bring not one, but many Borlaugs, but it will not make any difference in progress, given the complex trait we are dealing with. I explained how difficult and time-consuming it is to combine so many complexly inherited indices of basmati quality in a high-yielding background. I remember how I, along with my small staff, used to be in the field all day selecting productive plant types in the breeding populations and the long hours we spent into the night cooking rice to evaluate the promising lines for the desired quality trait combination.

GENE HETTEL, IRRI

DURING THE 49th Annual Rice Group Meetings of the All India Coordinated Rice Improvement Project, last year in Hyderabad, Dr. Siddiq (*right*) confers with Ruaraidh Sackville Hamilton, head of IRRI's T.T. Chang Genetic Resources Center.

E.A. SIDDIQ ARCHIVE

BASMATI RICE is believed to have been cultivated on the Indian Subcontinent for centuries. The term is of Sanskrit origin ("vasmati"), meaning "fragrant".

Yet, we failed to reach the targeted genotype for years. It took us nearly 24 years to finally succeed in developing Pusa Basmati 1 (PB1), the first-ever high-yielding semidwarf basmati variety, released in 1989. Just like with the miracle high-yielding IR8, which would not have sustained us had we not come up with progressively improved versions of it with acceptable grain quality and resistance to insect pests and diseases, PB1 also provided the genetic base for evolving better and better varieties and hybrids.

Breeding for the rice-wheat rotation

I was also very interested in developing an appropriate rice variety that would enable timely harvest and thus timely planting of wheat in Punjab, Haryana, and western Uttar Pradesh. With the fertile soil there, high fertilizer application causes modern rice varieties to lodge before harvest hence the rice cannot be combine-harvested. Keeping this problem in mind, we had introduced Pusa 44 in 1994.

Pusa 44 does not lodge at all because of its strong straw. This variety has helped sustain the rice-wheat system by enabling combine harvesting that clears the field quickly for proper land preparation and timely wheat planting. This is why the rice-wheat rotation in the region is such a great success. By virtue of this trait along with its long, slender, and clean grains as well as resistance to most pests and diseases, it is still popular in the region. Even today, there is no variety yet to replace Pusa 44.

Adding biotechnology to the toolbox

I looked into the prospects of the application of biotech tools for directed and speedy rice improvement. After a full day's discussion with me, Gary Toenniessen, representing the Rockefeller Foundation, agreed to support a rice biotechnology program in India, if we organized and coordinated it. Thus, the India Rice Biotechnology Network started. For 10 years, I coordinated this program involving rice researchers engaged in biotechnology.

Under this program, the Foundation helped India by training our young researchers in advanced laboratories abroad and providing all needed equipment. Although the funding support was not high, I must admit that, if not for that initial support, it would not have been possible for India to have built its rice biotechnology research to the level we have today.

Future challenge for India: keeping rice farming sustainable

The challenge for the next 20 years and beyond is achieving production targets on a sustainable basis—ecologically and economically. Whereas the unfolding technological advances will hopefully make farming ecologically secure, the real challenge is going to be in making farming economically viable because it is becoming increasingly a losing profession.

Farmers are not a happy lot in this country today. They don't have secure livelihood opportunities in the rural areas because rice farming and agriculture, in general, are not professionally attractive. Thus, there is a large-scale migration of rural families to urban areas in search of better livelihood opportunities. It used to be 60–40%, rural to urban population; now, the reverse is being reflected.

Today, many farmers do not want to see their sons becoming farmers like them. They want them to go for better-paid jobs in the cities. A recent survey conducted across India showed that more than 60% of the farmers don't find farming socioeconomically attractive. They feel they are losers and they want to migrate to urban areas. So, unless we come up with appropriate strategies and policy measures to sustain farmers in farming, it is not going to be easy to meet our future food demands.

A schoolboy in retirement, freely sharing knowledge

Now in retirement, among other things, I am an adjunct professor at my old institute, IARI. Whenever I go to Delhi, I give lectures to students and interact with the staff on many agricultural issues. I really enjoy this kind of activity in retirement. My wife says, "You are retired, but you still act like a schoolboy." Maybe so; however, for a scientist, there is really nothing like retirement. I now have time to read and think about the new developments in science and share those ideas with students and younger colleagues.

Many companies have asked me, "Why don't you do some sort of consultancy?—whatever you want, we will arrange." I said, no. I don't need financial support from anybody. I have my pension; I have my lifetime savings to survive and act as I wish. If anybody wants a free consultancy, there's no problem. I am available. Otherwise, I am leading a peaceful life!

Mr. Hettel is editor-in-chief of Rice Today.

See some video clips from Dr. Siddiq's interview at http://tinyurl.com/Siddiq-interview.

Rice scholars in South and Southeast Asia:

Apply now!

The Lee Foundation Rice Scholarship Program is offering scholarship grants to students pursuing their PhD in fields allied with the rice sciences.

Research areas
- Gene discovery and bioinformatics
- Modern rice breeding
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Types of scholarship
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Requirements for eligibility
- Citizen of a country in South or Southeast Asia
- Involved in rice science and related systems research
- Willing to work on any of a specified list of research areas for his or her PhD
- With great potential for scientific achievement
- About to enroll in a PhD program or have gained admission to an approved course at University of Illinois at Urbana-Champaign
- An adequate level of proficiency in English
- Not more than 35 years old at the time of application

The grant supports a 4–5-year PhD program that will be pursued jointly at IRRI and at the Department of Crop Sciences (http://cropsci. illinois.edu/) and the Illinois Plant Breeding Center (http://plantbreeding.illinois.edu/) of the University of Illinois at Urbana-Champaign.

The Lee Foundation Rice Scholarship Program aims to educate and train a new generation of young rice scientists and researchers to help feed Asia. This exciting new program offers young South and Southeast Asians a unique opportunity to gain excellent education from reputable academic institutions. It is anticipated that they will be part of a new science leadership in the region and build key partnerships for over 20-25 years.

How to apply

Submit an application online on or before 15 May 2015. For more information, send an email to irritraining@irri.org.

IRRI

Rice scientists from India helping Africa

Venuprasad Ramaiah:
A passion for rice genetics and breeding

by **Savitri Mohapatra**

DR. RAMAIAH confers with Arnaud Gouda, a research technician in the AfricaRice Biotechnology Laboratory, where they are "mining" for alleles in the genebank.

R RAMAN, AFRICARICE (2)

Like many of his classmates, Venuprasad Ramaiah was planning to become an engineer. But, during his first year of bachelor's degree studies at the University of Agricultural Sciences in Bangalore, India, a course in plant genetics taught by an inspiring teacher, Ms. Savithri Amma, marked a turning point in his life.

"For me, that was a 'wow' moment," said Dr. Ramaiah, a scientist at the Africa Rice Center (AfricaRice). "It sparked a passion in me for research in this field. There has been no looking back since then."

After completing his PhD in genetics of grain yield and root length under drought stress in rice, which he pursued at the same university and at the International Rice Research Institute (IRRI) in the Philippines, Dr. Ramaiah obtained a postdoctoral fellowship at IRRI and, later, at The World Vegetable Center in Taiwan. He then took up the position of a project scientist in the groundnut breeding unit of the International Crops Research Institute for the Semi-Arid Tropics, in Hyderabad, India, in 2009. However, since he was keen to return to rice research, he decided to join AfricaRice as a lowland-rice breeder in 2010.

"My family friends and colleagues thought I was crazy for leaving an attractive position in India, but I am passionate about rice research," Dr. Ramaiah remarked. "I also strongly believe that the real need is in Africa, where even small contributions can have more impact on the livelihoods of farmers than in Asia."

At AfricaRice, Dr. Ramaiah works on rice breeding for the rainfed lowland ecosystem with national programs under the Africa-wide rice breeding task force, which covers about 30 countries, and with international organizations, particularly IRRI. He is also closely involved in training research staff and students.

His team has successfully transferred the *SUB1* submergence-tolerance gene–identified by IRRI scientist David Mackill and U.C. Davis researcher Pamela Ronald–into two important rice varieties in West Africa (WITA4 and NERICA L-19) that are susceptible to flooding. These Sub1 varieties will be disseminated to rice farmers in flood-prone areas in Africa.

Building on his successful work on drought tolerance at IRRI, Dr. Ramaiah is coordinating an important project at AfricaRice to identify genes for drought tolerance, anaerobic germination, and iron toxicity. The project is done in partnership with Cornell University, IRRI, and the National Institute of Agrobiological Sciences in Japan and with support from the Bill & Melinda Gates Foundation.

Dr. Ramaiah's pioneering work has already led to the identification of extremely promising material among the more than 2,000 accessions in AfricaRice's genebank.

These efforts are expected to deliver better stress-tolerant varieties to small and poor African rice farmers in rainfed areas. These varieties will help make the farmers' yield and income stable as well as protect them from the threats of climate change.

"Despite all the challenges in Africa, it is most rewarding for me and my team to see the results to products and feel that we are a part of it," said Dr. Ramaiah. "We feel immensely proud that, with proper resources, we can do research on a par with the best organizations in the world."

Senthilkumar Kalimuthu:
A stargazer with feet firmly planted on the ground

DR. KALIMUTHU (*right*) confers in the field with Task Force members.

Senthilkumar Kalimuthu loves astronomy and space science and named his son Majoris, after one of the largest stars known to mankind. Yet, as a systems agronomist at the Africa Rice Center (AfricaRice), he has his feet firmly planted on the ground.

Born to a farming family in Ramanathapuram District in Tamil Nadu in southern India, Dr. Kalimuthu vividly remembers his school holidays, which he spent helping his mother on their farm. He recollects the anxiety of farmers in his village as they prayed for rain.

"When rain didn't come, our rice plants failed to flower and often we had to harvest feed for cattle instead of food for us," he said.

This experience led him to take up agriculture during his undergraduate studies and focus on water-saving rice cultivation technologies as the topic for his MSc and PhD research so that he could help such farmers.

Dr. Kalimuthu is justifiably proud that not only did he receive the Thirumathi K. Rangammal Award for his MSc research from the Tamil Nadu Agricultural University, but also because his findings were later disseminated to more than a million farmers in Tamil Nadu through the Department of Agriculture.

His work was so much appreciated that he was able to receive initial funding from the Dutch government for his doctoral research at Wageningen University in The Netherlands. On completion, he became a postdoctoral researcher at Wageningen University and later in the French National Institute of Agricultural Research in France.

Since he was keen to help rice farmers and make an impact on the ground, Dr. Kalimuthu joined AfricaRice in 2012 as a systems agronomist at the Center's regional station in Tanzania. Explaining the potential impact of research in Africa, he said, "Through agronomy, it is possible to double the national average rice yield in Tanzania to 4 tons per hectare. This 'potential' is what drives me to work in and for Africa."

Senthilkumar is coordinating the activities of the Agronomy and Mechanization Task Forces convened by AfricaRice in Eastern and Southern Africa. He is also monitoring rice R&D activities in 12 rice sector development hubs across Tanzania, Uganda, Madagascar, Rwanda, and Ethiopia, where he has trained more than 200 rice researchers and 350 rice farmers in rice agronomy, of which 40% are women. He is also supervising students, research assistants, and some researchers.

His studies and experience are helping him to realize his dream of becoming an eminent agronomist. Importantly, the lessons that he learned during his childhood from his mother on their farm are continuing to guide his footsteps.

Recounting one such lesson, he said that, when he was walking on their farm with his mother, his feet would press on roots of rice plants. He was worried that he was damaging the plants. But his mother assured him that destroying rice roots a little would produce more tillers and more yield. "I didn't understand at that time. But now, through my experiments, I see how the roots get pruned by mechanical weeding. This helps increase rice tillering and yield.

Ms. Mohapatra is the head of Marketing and Communications at AfricaRice.

Nuggets of Planetary Truth

(The Earth's Fever)

D·V· Seshu

Former IRRI plant breeder (1976-93) and global coordinator, International Network for Genetic Evaluation of Rice·

He is now a consultant, International Agricultural Research, Rockville, Maryland, USA·

Oh! The horrid global warming
Life on earth is no more charming
All across, there's climate change
Nature spewing forth, all its rage

Mother earth purveys, all our needs
Yet we fault it, with sordid deeds
Pristine resources, we put on line
To future we bequeath, none sanguine

Passion for non-renewables, a frontrunner
Concerns for future, on backburner
Resource overdraft is foolhardy
Putting the lives ahead, in jeopardy

Smothering trees, with senseless greed
Bothering hardly, for future need
Razing the forests, without rue
Can't have the cake and, eat it too

Sky is the limit for corporate schemes
Earth can't shore up, all those dreams
Technologies surged to a cutting edge
Yet, environmental issues we simply hedge

To overhaul ephemeral prosperity
We firewall the lifelines to posterity
Economy boom, nay, ecology doom
Future hustled into a quagmire of gloom

Materialistic world in a malefic race
Profaning resources, for an iconic place
Industrial metabolism, going astray
Planet's physics, in flustered array

Greenhouse gases, knocking the skies
Planet's fever, reaching new highs
Scars on earth are hard to hide
For, the laws of earth been set aside

Distant hills are hardly smooth
Climate change has unwrapped the truth
Grass on far side, no more green
Rising fever hath blown off the sheen

Land or ocean, mountain or air
Diversity of biota, all in despair
Affront on habitats, holding no bars
Forlorn earth been, molding as Mars

With rising fever, oceans sway
Crimson corals, blotching away
Melting snows been fleeting to shores
Polar bears onto, joining dinosaurs

Laid in stratosphere, the ozone layer
Stands aloft, as hallowed savior
Rived by noxious, emissions and sprays
Lets the sun emit, harmful rays

To judge the nature's fury
We have, none to sit on jury
For, all of us stand in defense
Due utter lack of earthly sense

To mitigate issues, the earth been beset
Rev up actions, to restore its assets
Take no more than, what you can replenish
Conserve resources, for future to flourish

DRR Rice Museum features traditional wisdom and scientific breakthroughs

by **B. Mishra**

ENTRANCE TO the DRR Rice Museum in Hyderabad.

In India, rice has been grown since time immemorial. Here, the rice grain has always been considered sacred. The spirit of the Divine is believed to reside in each rice grain. Rice is a symbol of fertility and being used in worship wherein grains are offered to God.

Rice is the essence, a way of life and it is blended with festivals, traditions, rituals, and each walk of life of the rice farmers. It is seen in music (particularly folk songs), poems, art, and sculpture. Large parts of folklore have become interwoven with rice culture. For more than half of humanity, rice is life, providing its nurturing energy. Indeed, many consider the crop as the root of civilization.

As a rice researcher for nearly four decades and as project director of the Directorate of Rice Research (DRR) for 5 years, I realized the need for establishing a rice museum that depicted a combination of traditional wisdom and the major breakthroughs of science and technology in breeding (release of Sub1 varieties and hybrids), management practices (direct seeding and aerobic rice), pest and disease management, crop resource management (agronomy), postharvest technology, engineering, biotechnology, and genomics.

R.M. SUNDARAM, DRR senior scientist in biotechnology (*second from right in upper photo*), gives special guests a tour of the Rice Museum including (*from left*) Bas Bouman, GRiSP director; J.K. Ladha, IRRI representative for India; and (*extreme right*) Matthew Morell, IRRI deputy director for research. The bottom photo shows the panoramic mural in the background.

An integral and crucial part of the DRR Rice Museum is a mural painting that gives a panoramic view of the various operations of traditional and science-based rice farming. It depicts the different rice ecosystems—irrigated, upland, shallow lowland, semi-deep water, deep water, and floating rice. It also shows seed production plots and hill rice.

The mural illustrates how rice farmers' lives are governed and regulated by the seasonal rhythms of rice growing—sowing, planting, fertilizing, weeding, irrigating, harvesting, threshing, and hulling. Their lives from birth to death are bound to rice.

As the staff and collaborators of the DRR celebrate its 50th anniversary, the DRR Rice Museum is observing its 10th year of operation, having opened its doors on 31 March 2005. The panoramic mural, particularly, has been a solemn place for staff and visitors to pause in the museum—to take some quiet time to reflect on the importance and significance of India's rich and diverse rice culture.


SECTIONS OF the mural show various Indian rice farm operations. See a larger segment in the centerfold on the next page.

Dr. Mishra was project director for the DRR, 2000-05. During his time, 144 inbred rice varieties and 9 hybrids suited for different rice ecologies were released. He facilitated the development of hybrid rice in India, which is now planted on around 2.4 million hectares. He coordinated the largest AICRIP network on rice up to that time, having 47 funded projects and more than 90 cooperating centers with nearly 500 rice scientists.

A section of the panoramic mural housed at the Rice Museum of the Directorate of Rice Research in Hyderabad, India. It depicts how rice farmers' lives are governed by the seasonal rhythms of growing the crop. See the previous page for more background.

A time to celebrate, pause and reflect…

REVISITING 50 YEARS OF INDIAN RICE RESEARCH

Compiled by **Gene Hettel**

In December 2014, I noted that 2015 would mark the 50th anniversary of India's Directorate of Rice Research (DRR) and the Annual Rice Group Meeting of its All India Coordinated Rice Improvement Project (AICRIP). So, at that time, J.K. Ladha, the International Rice Research Institute's (IRRI) representative in India, and I encouraged a cadre of renowned Indian rice scientists and administrators to provide some brief recollections and testimonials, particularly espousing the exceptional partnership between India and IRRI. We also asked a long-time DRR breeder to provide her unique look at AICRIP's legacy.

Responses were heartening, enthusiastic—and enlightening. In addition to historical perspectives, topics ranged from achievements in hybrid rice and building India's scientific capacity to addressing climate change. What follows here are some selected gleanings. The complete set of contributions is at www.irri.org/rice-today/india.

A time to celebrate, pause, and reflect

In her detailed account of *Five decades of AICRIP,* N. Shoba Rani writes about the program's growth and contributions to the rice revolution in India. The acting director of the DRR/AICRIP for a time in 2014, she states that the Golden Jubilee of AICRIP, which received directorate status as the DRR in 1975[1], is a time to celebrate success and a time to pause and reflect on the way forward and to face new challenges. "It is also a time to hear the heartbeat of the rice farmers," she adds.

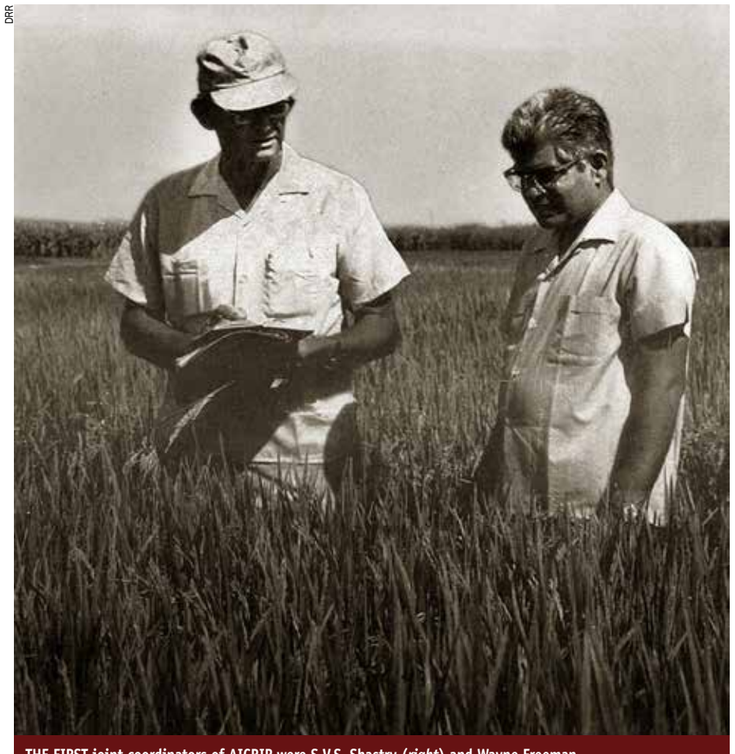
According to Dr. Rani, the Indian Council of Agricultural Research (ICAR) located AICRIP in Hyderabad in 1965 with a mandate at the time to develop an integrated national network of cooperative experimentation on all aspects of rice production. "Accelerating breeding with the new semidwarf varieties arriving on the scene would be a key effort," she says.

IRRI's connection in India formally started with AICRIP

The Rockefeller Foundation, the U.S. Agency for International Development (USAID), and IRRI were soon associated with the project to enhance the pace of rice research in the country.

According to S.K. De Datta, one of IRRI's first agronomists, serving there from 1964 to 1991, IRRI's collaborative research with India was formally launched shortly after AICRIP's establishment. "ICAR appointed S.V.S. Shastry, a distinguished breeder and geneticist, as its coordinator and project leader while the Rockefeller Foundation designated Wayne Freeman as the joint coordinator," says Dr. De Datta. "Dr. Freeman also later served with distinction as IRRI's first representative in India."

DRR



THE FIRST joint coordinators of AICRIP were S.V.S. Shastry (*right*) and Wayne Freeman.

As AICRIP's first manager, Dr. Shastry, who also served on IRRI's Board of Trustees in the early days (1970-73), saw his priority being project implementation and not so much bureaucratic things such as memoranda of understanding and streamlining administration. "The focus was on the semidwarf cultivars, which covered the entire research area of the AICRIP center in Hyderabad," he says.

"The bread and butter of crop improvement is genetic enhancement and crop husbandry," he adds. "The genotypes must be matched with the biological and physical environment in which the crop is grown. IRRI and AICRIP met this challenge guided by the competence and vision of the scientists at both institutions."

The key to success: germplasm exchange

According to the DRR's current director, V. Ravindra Babu, AICRIP's varietal improvement has involved the pooling of breeding material generated in more than 100 regional rice-breeding stations across India. "This has allowed for testing under different rice ecologies and agroclimatic zones," he says. "The greatest advantage has been the free exchange of genetic material at both the national and international levels through IRRI's International Network for Genetic Evaluation of Rice or INGER."

IRRI

INGER IS celebrating its own 40th anniversary in 2015.

"India has benefited from its partnership with INGER by directly releasing 70 entries from diverse sources to date as varieties," says D.V. Seshu, former IRRI plant breeder (1976-93) and an early INGER coordinator. "The use of several hundred test entries as parents in various breeding programs led to the release of an additional 252 varieties in 24 Indian states. INGER entries were also used directly as either restorer or CMS[2] lines that led to the release of around 40 hybrids in India."

Developing hybrid rice from scratch

Speaking of hybrid rice, the India-IRRI collaboration is a unique example of how to develop such a technology from scratch, according to Sant Virmani, IRRI plant breeder (1979-2005) and former leader of IRRI's Hybrid Rice Program.

"We encouraged India's private sector to develop and disseminate hybrid rice technology by freely sharing IRRI-developed hybrid materials and seed production technology with them," says Dr. Virmani. "This concerted effort resulted in the development and commercialization of hybrid rice by 1994. In recognition of this development, India, in collaboration with IRRI, hosted the 3rd International Symposium on Hybrid Rice in 1996.

"IRRI has supported the hybrid program in India by continuously sharing breeding materials and seed

[1] In its Golden Jubilee year, the DRR has been given national institute status under the ICAR umbrella. It is now the Indian Institute of Rice Research.

[2] CMS or cytoplasmic genetic male sterile is a plant's inablity to produce functional pollen. It is an important tool in hybrid seed production. Hybrids often exhibit heterosis or hybrid vigor, whereby the traits of a hybrid progeny are enhanced as a result of the genetic combination of its parents.

GENE HETTEL, IRRI

SINCE 1989 when ICAR implemented a national program on hybrid rice development, IRRI researchers have contributed much to improving this technology, which can greatly increase India's rice production and farmers' income.

production technology and providing regular consulting services through visits by Institute breeders," adds Dr. Virmani. "Concurrently, IRRI has enhanced the capacity of Indian scientists and seed production personnel with postdoctoral, on-the-job, and short- and medium-term training in the Philippines as well as in India."

Capacity building is critical

Others in the cadre also mentioned the critical importance of capacity building. Professional advancement for Indian scientists has been key, not only in hybrid rice development, but in many aspects of rice research.

According to Mano Pathak, former IRRI director of research and training (1974-89), the Institute's training programs were initiated to provide MS, PhD, and postdoctoral research programs. "Additionally," he says, "short-term nondegree programs on rice production, pest and soil management, and postharvest technology have been an important feature of the Institute's intensive training courses, some up to 6 months in duration."

Since 1965, Indian scholars who have trained and done research at IRRI tally around 110 PhDs, 15 MSs, 135 interns, and 15 research fellows. "Many Indian scientists, who are part of the IRRI alumni network, now occupy key leadership positions in ICAR and the university system and are significantly contributing to the country's rice crop production and use," points out Dr. Pathak.

IRRI

SINCE 1965, more than 1,000 Indian scientists have attended IRRI's short- and medium-term courses.

"A major recent achievement in India-IRRI capacity building is in simulation modeling for climate change impact assessment and resource optimization for environmental sustainability," adds Himanshu Pathak, Center for Environment Science, Indian Agricultural Research Institute. "The various workshops and conferences on climate change and environment will go a long way in achieving sustainable livelihoods for millions of Indians."

Pradeep Sharma, vice chancellor of Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, adds management of soil and water to the list that IRRI supports for capacity building in India. "These two natural resources are threatened by overexploitation and misuse as well as by climate change," he warns.

Global climate change: a pivotal issue

Many in the cadre obviously had this issue on their minds—and with good reason. "Global climate change—characterized by increasing temperatures, more variable rainfall, sea-level rise, and melting glaciers—is projected to significantly impact rice production in India and neighboring countries, and affect the food and livelihood security of millions," says Pramod Aggarwal, regional program leader for South Asia of the CGIAR Research Program on Climate Change, Agriculture, and Food Security (CCAFS).

According to Dr. Aggarwal, India and IRRI share a long research collaboration to study the relationship between rice and the climate. "For example, IRRI and ICAR scientists worked together to set up automatic methane gas measuring facilities, which were instrumental in producing revised estimations of methane gas emissions, leading to a downward evaluation of emissions from the agricultural sector."

He points out that now IRRI and the International Maize and Wheat Improvement Center (CIMMYT) are working with CCAFS on obtaining greenhouse gas estimates under different management practices in farmers' fields in several "climate-smart villages" in India and South Asia. "These studies will lead to the development of more robust measurement, reporting, and verification systems for methane gas emissions in rice paddies," says Dr. Aggarwal.

Farmers in the climate-smart villages in eastern India have been given access to drought- and flood-tolerant rice varieties, such as Sahbhagi dhan and Swarna-Sub1, respectively, among many other adaptive practices. "Water-saving and low-emission practices such as alternate wetting and drying and direct-seeded rice are an integral part of the climate-smart portfolio in these villages," he adds.

APAARI's regional role

In Asia, IRRI has interacted closely with the Asia Pacific Association of Agricultural Research Institutes (APAARI) since its inception in 1990. APAARI and IRRI have had a long partnership in promoting and initiating rice research for development activities in India and South Asia, according to Raj Paroda, former APAARI executive secretary (1992-2014), ICAR director general (1994-2001), and IRRI Board of trustees member (1990-93). "For example," says Dr. Paroda, "APAARI, on the advice of IRRI, published the book *Hybrid rice in China*, which helped promote hybrid rice research in India."

Dr. Paroda added that APAARI helped facilitate the germplasm exchange activities of INGER in India, worked with IRRI and CIMMYT to initiate the Rice-Wheat Consortium for the Indo-Gangetic Plains in 1994, and enthusiastically endorsed the CGIAR's Global Rice Science Partnership (GRiSP) in 2010.

LANIE REYES, IRRI

EAST INDIAN rice farmers are now meeting their food security needs with climate-smart varieties, such as drought-tolerant Sahbhagi dhan. See *Creating an oasis with rice* on pages 10-11 of *Rice Today*, Vol. 13, No. 2.

Impact of the Green Revolution

All of the products and activities of the ongoing Green Revolution have had remarkable impact in India. "During the 1960s, the country imported up to 10 million tons of food grains annually," says Gurdev Khush, 1996 World Food Prize laureate and IRRI rice breeder and principal scientist (1967-2001). "For the last 10 years, India has exported 4–6 million tons of food grains every year," he says. "The quantity of rice exported in 2013-14 was 10.7 million tons—more than any other country. Considering that the population of India has increased from 350 million in 1960 to the current 1.254 billion, this is a remarkable achievement."

Mutual benefits and rewards

"IRRI and ICAR have always been natural partners," says Dr. Swapan Datta, former ICAR deputy director general (crop science) and IRRI tissue culture specialist and plant biotechnologist (1993-2005). "That dynamic partnership has become successful and beneficial for both institutions."

DRR director Babu agrees. "IRRI has been a key R&D partner of the DRR for the last 50 years—and the rewards have been mutual," he says. "I am sure that, through continued collaboration between the two organizations as equal partners, we will be able to meet India's future challenges to rice production and productivity."

Mr. Hettel is editor-in-chief of Rice Today *and IRRI historian.*

Yield rises with **WeRise**

by **Keiichi Hayashi, Anita Boling,** and **Tsutomu Ishimaru**

A weather-rice-nutrient decision support app is helping farmers ensure yield in rainfed areas

K. HAYASHI (3)

Unreliable weather can make or break rice farmers that rely on rainfall for water. Climate change makes it even harder to predict weather conditions, thus lowering the chances of recovering farmers' investments in mitigating the impact of erratic rainfall patterns on their crops. To help solve this problem, a prototype weather-rice-nutrient integrated decision support system (WeRise) came about. WeRise is a web application tool that integrates rice nutrients with weather data to provide farmers with weather and crop advisories.

Rice roulette

Growing rice in rainfed environments is like gambling. It is difficult for farmers to decide when to sow or transplant rice because they cannot predict the arrival of the monsoon. They also cannot foresee whether the season's rainfall will be enough to sustain their crops. Even with sufficient rainfall at the beginning of the season, they have no guarantee the rain will continue. Obviously, too much or too little rainfall can lead to a poor harvest. The weather can also inflict damage during harvest time. If harvesting coincides with rains, farmers need plastic sheets to keep grains dry. The bottom line is that no one can tell how much of their investment can be recovered after a cropping season.

Optimal production can be achieved through good agricultural practices, which can be designed to fit the different types of rainy season. For example, a long-cycle rice variety should be chosen for long rainy seasons with sufficient rainfall. In areas where the rainy season is short, a short-cycle variety is suitable for coping when water is scarce. If the rainy season is long enough but rainfall is insufficient, a drought-tolerant rice variety can be a good candidate.

When drought occurs, a short-cycle variety should be used to avoid water shortage at the critical stages of plant growth. However, these decisions are made at the start of the planting season. Farmers cannot change the variety of their choice after they have planted it.

Tailor-made weather and yield reports

WeRise is a product of collaboration between the International Rice Research Institute (IRRI) and Japan on the project Climate Change Adaptation in Rainfed Rice Areas (CCARA). WeRise aims to improve the chances of farmers of having good rice yields even with unpredictable weather patterns. Japan's Ministry of Agriculture, Forestry and Fisheries funds CCARA.

WeRise provides crucial weather and grain yield advisories in the form of a narrative summary. This includes the start and end of the rainy season, the expected rainfall distribution and flooding or drought that might occur during the season, when to sow and transplant the crop, what variety is appropriate, and how to apply fertilizer efficiently. It also contains graphical outputs of rainfall, minimum and maximum temperatures, wind speed, vapor pressure, and solar radiation.

These sets of information are location-specific to subdistrict levels of countries in Southeast Asia. The seasonal weather predictions are based on the localized outputs of the Scale Interaction Experiment-Frontier (SINTEX-F) Research Center for Global Change developed by Japan's Agency for Marine Science and Technology. SINTEX-F is designed to predict when the El Niño Southern Oscillation will occur, 1 to 24 months in advance. Thus, WeRise can provide farmers with predicted weather and yield information with enough lead time for them to prepare and decide what and when to plant.

WeRise can also predict yield based on recommended sowing and fertilizer application timings using the ORYZA crop modeling tool, which simulates the growth and development of rice as well as water under different conditions, including local weather. The grain yield advisory is also location-specific so that end-users can choose a subdistrict for this advisory.

From theory to field reality

In rainfed rice farming, the timing of sowing is crucial because good yield is linked to a sufficient water supply and good crop growth. Some farmers plant early while others are more cautious and start sowing late in the monsoon. Relying mostly on guesswork, farmers can have high or low yields as a result of coincidence; thus, they cannot obtain the same result in the following year.

In 2014, WeRise was tested in Indonesia to see whether it could minimize the effect of poor timing. Although many farmers started sowing rice after a downpour at the beginning of the rainy season, the WeRise team, following its weather prediction, planted rice much later.

A few weeks after the farmers planted, rainfall stopped. The young rice seedlings planted by the farmers suffered from water scarcity and some plants did not survive. The WeRise team, on the other hand, obtained significantly higher yield than the farmers who did not receive any weather advisory and relied on their instincts.

A user-friendly tool

WeRise is designed for agricultural extension agents and farmers who can access the Internet through smartphones or computers. Local millers and retailers of agricultural inputs are potential users who can be sources of information for farmers with no Internet access. WeRise is now available in English, Bahasa, and Lao, making information dissemination even simpler for small-scale rice farmers who are not tech-savvy.

The feedback from 53 research and extension workers in Indonesia, Lao PDR, and the Philippines has been positive. They found WeRise easy to use and understand. They also said that explaining the advisory to farmers was easy.

A CROPPING calendar based on accurate weather information could mean better rice yields for farmers.

"The information is more complete and it has graphs," said Beby Noviani, an extension worker from Indonesia.

Muhammad Jono, another Indonesian extension worker, summed up his experience with WeRise in one word: "simple."

Raising farmers' odds

With WeRise, rice farmers will be able to use their resources efficiently by choosing a suitable variety, avoiding a failure in crop establishment, and using an efficient fertilizer application. This can help reduce their risks and make rainfed rice farming better and more stable. By providing farmers with timely, accurate information, farmers can enjoy better harvests, which translate into higher earnings and more reliable profitability. Thus, WeRise could make rainfed rice farming attractive to young people by changing the perception that rainfed agriculture is an all-or-nothing occupation.

Drs. Hayashi and Ishimaru are seconded scientists from the Japan International Research Center for Agricultural Sciences (JIRCAS) working on the CCARA project. Dr. Hayashi is the project coordinator who leads the agronomy and soil science component. Dr. Ishimaru is a plant breeder who leads the genetics and breeding component. Dr. Boling is a former postdoctoral fellow of CCARA.

ARFUSA announces 2014 grant winners and 2015 application deadline

ARFUSA aims to encourage and support the next generation of rice scientists through its Travel and Study Grants awarded to young scholars.

ARFUSA grants (up to $3,500 per award) assist scholars and artists to learn more about rice in the developing world by subsidizing a trip to a country where rice is important to study aspects of rice production, marketing, consumption, and policy or to create art or interpret culture related to rice.

2014 grant winners

The two grant winners in 2014—Ana Maria Bossa Castro from Bogota, Colombia, and Haley Sater from Minnesota USA—are traveling to IRRI in the Philippines.

Ms. Bossa Castro, a second-year PhD student at Colorado State University (CSU), is conducting research that involves *Defeating Bacterial Diseases of Rice: Novel Resistance Sources for Rice Crops in Africa and Latin America*.

At IRRI, she will participate in the Institute's 2015 international course, *Rice: Research to Production*. The 3-week course in August will provide her with a unique opportunity to learn from experts about the latest rice research. She will also meet with IRRI scientists collaborating with her to update them about her bacterial disease research.

Ms. Sater, working on her master's degree at the University of Arkansas, is conducting research to obtain better abiotic stress tolerance in rice. Her time at IRRI involves a 3-month research project with breeders there to help close the information gap regarding dual drought and salinity tolerance in rice.

2015 grant application

1 June 2015 is the deadline for receiving the next round of grant applications. Student applicants who may be of any nationality must be registered at an accredited U.S. university or college and have a letter of support from a university faculty member. Creative artists must illustrate their qualifications.

Evaluation of the applications is based on quality, likely contribution to knowledge or ability to cause people to think, potential contribution to resolving issues related to rice in Asia, and leadership potential of the applicant. For more information on sending applications, go to **www.asiariceusa.org/awards.html**.

Find out more about ARFUSA and its important mission at **www.asiariceusa.org**.

What's cooking?

by **Ms. Lynda Hagan**

Noodle extruder

Ms. Agbezudor, technical assistant at FRI in Ghana, shows how to make rice noodles.

Recipe by Ms. Lynda Hagan, research assistant at FRI.

With increasing urbanization, the demand for convenience foods such as rice preparations is rising in Africa. Tasty and innovative uses of rice, such as for rice noodles, can promote rural enterprises and raise income, especially for women processors.

Ms. Lynda Hagan, research assistant at the Food Research Institute (FRI) in Ghana, has developed a recipe for noodles using rice and wheat flour as part of an effort to develop and promote higher value rice-based products.

The rice-flour noodle is a variation of the wheat-flour noodle generally imported from Asia into Africa. Joyce Agbezudor, a technical assistant at FRI, demonstrates how to prepare home-made rice noodles.

R RAMAN, AFRICARICE (4)

Home-made noodles from Ghana

Ingredients

- 250 grams rice flour
- 250 grams wheat flour
- 165 grams egg whites
- 25 grams xanthan gum
- 10 grams salt
- 200 milliliters water (add a pinch of food coloring)
- 25 mL or 5 tsp cooking oil

Directions

Preparing the noodles (one or two days before cooking the noodles)

- Mix rice and wheat flours, xanthan gum, and salt in a bowl.
- Add egg whites and cooking oil, and mix well.
- Gradually pour 200 mL of water into the flour mixture and mix it with a fork or your fingertips to form a soft dough. Place the dough on a lightly-floured work surface and knead for about 5 minutes until smooth and elastic. Set it aside for 20 minutes.
- Knead dough once more and pass the dough through the noodle extruder. If a noodle extruder is not available, loosely roll the dough on a rolling pin and cut the dough into strips of desired width.
- Sprinkle flour on a tray and carefully unfold the strands in the tray.
- Dry the noodles in the sun for one day.
- Store dried noodles in an airtight container at room temperature.

Cooking the noodles

- Boil about half a liter of water in a pot. Add a little salt and oil.
- Add 100 grams of noodles, cover the pot, and let the noodles simmer for 5 minutes or until they are soft. Test the noodles frequently because they become mushy if overcooked.
- Drain the noodles using a colander.
- Rinse the noodles under cold water to stop the cooking. Drain once more.
- Serve warm rice noodles with any sauce of your choice

Bon appétit!

Watch Ms. Agbezudor prepare the home-made rice noodles in a 5-minute video on YouTube at http://goo.gl/xZFG9y.

What LATIN AMERICA's rice sector offers the WORLD

by **Adriana Varón Molina**

ADRIANA VARÓN MOLINA (3)

There is one occasion that Brazilian farmer Geovano Parcianello never misses. Every year, he travels 503 kilometers from his farm in the municipality of Alegrete to the city of Cachoeirinha, where the most important rice experiment station in the state of Rio Grande do Sul is located. Being there with a thousand other rice growers gives Mr. Parcianello an opportunity to find out about new varieties, disease control measures, and options for crop rotation—knowledge he can apply on his own 900 hectares of rice.

An international technology festival

This year, the "technology festival" organized by the Rice Institute of Rio Grande do Sul (IRGA) had an extra dimension. Not only did participants come from places such as Alegrete, Santiago, San Antonio, and Itaqui but they also came from 33 countries of Latin America and the Caribbean (LAC), Europe, and Asia, making the field day international. The foreign guests were among 460 participants at the XII International Conference on Rice in Latin America and the Caribbean, which took place in Porto Alegre, Rio Grande do Sul, on 23-26 February 2015.

"Listening to presentations on topics such as genetics, crop improvement, agronomy, and climate change, and visiting the field plots opened our minds to what's happening in the rice sector, not only in the region but in the whole world," said Eliécer Araya, president of Costa Rica's National Rice Corporation (Conarroz, its acronym in Spanish). "This also gave us an opportunity to further reinforce the knowledge network that strengthens us all."

Taking LAC's rice sector to new "horizons of competitiveness"—the slogan of the conference—is a central aim for organizations such as the Latin American Fund for Irrigated Rice (FLAR) and its 35 members, the International Center for Tropical Agriculture (CIAT), IRGA, and the Brazilian Agricultural Research Corporation (Embrapa). The regional alliance draws as well on support from the International Rice Research Institute (IRRI), CGIAR's lead center for the Global Rice Science Partnership (GRiSP)—which believes in the important role of this region in the coming decades to meet the rising global demand for rice.

A world-stage performance

High productivity (with some countries obtaining yield as high as 16 tons per hectare), extensive mechanization, the use of direct seeding, and excellent grain quality are among the key features of LAC's production that are attracting world attention.

BOTH INDOORS via poster sessions and other presentations and outdoors via IRGA field plot demonstrations, conference participants learned about the latest developments in rice genetics, crop improvement, agronomy, and the effects of climate change.

"Latin America has enormous land resources and abundant water, and its rice production is technically advanced," said Robert Zeigler, IRRI director general. "The challenge for this region is to analyze global markets carefully and design strategies that will enable production to meet demand."

Joe Tohme, director of CIAT's Agrobiodiversity Research Area, stressed the importance of regional integration through networks such as FLAR and the Consortium on Hybrid Rice for Latin America (HIAAL). "CIAT's Rice Program helps countries across the region to strengthen their capacity and make production more competitive by using the genetic materials and agronomic practices that we and FLAR are developing," Dr. Tohme said.

"Strategic alliances are what can make us strong as a region," said Flavio Breseghello, director general of Embrapa Rice and Beans. "The presence of Asian scientists in Latin America, thanks to GRiSP, makes them more aware of our strengths and us more aware of theirs. The good practices of each continent complement one another."

National governments have a key role to play in building strategic alliances, explained Bas Bouman, GRiSP director. "The way forward is to strengthen national capacity, working side by side with governments and their programs, and devise strategies that enable countries in LAC to compete with the biggest rice producers in the world."

Ingredients of a production miracle

"There's little point in doing research without extension. The most important thing is transferring knowledge to producers—that's the key," said Carlos Pereira, former president of IRGA, who now works as an agronomist with the state's Agricultural Secretariat.

IRGA, with its 75-year history, offers a good example of how the rice production chain can be strengthened. In 10 years, growers in Rio Grande do Sul managed to raise average rice yield by 50%. This production miracle resulted mostly from a training program created for 100 IRGA technicians and extension agents from private companies and farmer cooperatives.

"We reviewed the latest knowledge from different research centers—CIAT, IRGA, IRRI, and universities—and took it to the field by means of the technicians," said Sergio Gindri, an IRGA researcher. "It was important to develop consistent messages on basic concepts, such as early weed control and the use of high-quality seed of improved varieties. But the route by which the Latin America and the Caribbean region reaches its goal of serving as a food basket for the world won't be easy."

"To position ourselves in international markets, we have to tackle basic issues such as seed quality, improved infrastructure for exports, and lower operating costs, with the aim of offering a higher quality product at a lower price," said Eduardo Graterol, FLAR's executive director. "The goal is to place surplus production in international markets, while ensuring that each country can supply enough rice for its own population."

The sun-drenched international field day ended with a banquet for Mr. Parcianello and the rest of the 1,500 guests, who feasted on *carreteiro*, a typical dish of Rio Grande do Sul, in which rice, of course, is the main ingredient—just as it is in the daily diets of more than half of the global population.

Ms. Varón Molina is communications coordinator for Latin America and the Caribbean at CIAT.

Averting hunger in Ebola-hit countries

by **Savitri Mohapatra**

RICE IS the most important staple in Sierra Leone, and Liberia, however, the Ebola crisis threatens to undo the progress made in improving domestic production.

R RAMAN, AFRICARICE (3)

"April is the cruelest month," wrote T.S. Eliot in *The Waste Land*. It was as if he were voicing the sentiments of the farming communities in Ebola-affected countries—Liberia, Sierra Leone, and Guinea. Though the time for planting has come, there is a desperate lack of labor and inputs, particularly seed, as hungry rice farmers ate the seeds they would have normally stored for planting in April.

Although there are signs that the Ebola epidemic is being contained in the three countries, a major food crisis is looming unless urgent steps are taken to tackle food security concerns, according to 2014 reports by the United Nations Food and Agriculture Organization (FAO) and the World Food Programme (WFP).

According to their estimates, the Ebola virus outbreak left slightly more than half a million people in the three countries "severely food insecure"—120,000 in Sierra Leone, 170,000 in Liberia, and 230,000 in Guinea.

The total number of affected people could double to one million in a few months unless urgent measures are taken to significantly enhance access to food and safeguard crop and livestock production in these countries, they warned.

The crisis has been further aggravated because Liberia and Sierra Leone were still recovering from prolonged civil wars while Guinea was still transitioning from military rule when Ebola struck.

In December 2014, the government of Sierra Leone banned all public celebrations, including Christmas and New Year, to prevent Ebola from spreading further. Similarly, Guinea, where the latest Ebola outbreak started recently, declared a 45-day "health emergency" in five regions in the western and southwestern parts of the country.

Shock to food and agricultural sectors

FAO and WFP stated that the Ebola epidemic had caused a significant shock to the food and agricultural sectors in the affected countries, where two-thirds of the people depend on agriculture for their livelihood. A number of interrelated factors, including quarantines, disruptions in transportation and trade, and rising food prices were triggering the food crisis.

Experts participating in the Global Rice Market and Trade Summit organized by the International Rice Research Institute in Thailand in October 2014 remarked that there was a noticeable rise in local rice prices in the affected countries, although the Ebola crisis was not expected to have a major impact on the global rice market.

The virus killed many productive farmers and many others abandoned their fields and harvests out of fear. In Sierra Leone, for instance, up to 40% of the farms in the worst affected areas were reported abandoned.

Impacts on the rice sector

Rice is the most important staple in the three countries and its price and accessibility directly influence social stability. Annual per capita consumption of rice (about 100 kg) is among the highest in sub-Saharan Africa. However, all three countries are net importers of rice as demand is much higher than local production.

Promoting domestic rice production is therefore important in the national rice development strategy developed by each of these countries under the Coalition for African Rice Development framework.

The national programs of these countries are involved in many joint projects with the Africa Rice Center (AfricaRice) and have identified Rice Sector Development Hubs. A rice hub is a mechanism introduced by AfricaRice across sub-Saharan Africa to concentrate R&D efforts and connect partners along the rice value chain to achieve greater impact.

In the past few years, AfricaRice has been providing targeted support to Liberia and Sierra Leone at their request to revive their respective rice sectors, under the World Bank-funded West Africa Agricultural Productivity Program (WAAPP). The main focus of this support is to make improved seed and technologies available to farmers, enhance rice quality, and develop a critical mass of scientists, technicians, extension workers, and seed producers.

Unfortunately, the Ebola crisis threatens to undo the progress made in all these areas. According to FAO, 2014 rice production was expected to decline by 12% in Liberia, 8% in Sierra Leone, and 4% in Guinea. But, there are big disparities within the region: production is down by 20% in Liberia's Lofa District, which is the main rice-producing region and is considered as Liberia's breadbasket, and by 17% in the hardest hit parts of Sierra Leone.

"The Ebola outbreak in Liberia is a complete setback to our achievements," said AfricaRice scientist Inoussa Akintayo, who is coordinating a World Bank-supported emergency rice project in Lofa and Bong districts in Liberia.

In August 2014, for reasons of safety, senior management of AfricaRice decided to pull out its regional and international researchers from Liberia and Sierra Leone. "This has affected the implementation of the planned activities," said AfricaRice scientist Bert Meertens, who is assisting the Sierra Leone Agricultural Research Institute in WAAPP activities.

A call for urgent action

Aside from controlling Ebola, FAO and WFP called for urgent action to re-establish farming systems in the three countries. Measures should enable the most vulnerable people to access agricultural inputs, such as seeds and fertilizers, and adopt improved technology to overcome labor shortages.

AfricaRice has been actively involved in discussing and planning strategies to make improved rice seed available to farmers with strong support from donors as well as the Economic Community of West African States.

In December 2014, the Center participated in Seeds for Agriculture in Ebola-affected Countries, a workshop organized by the African Development Bank in Abidjan, Côte d'Ivoire. The Center has been invited by the World Bank to join its efforts in providing rice seed to farmers in Ebola-hit countries in time for the 2015 planting season.

A USAID-AfricaRice initiative aims to provide technical support to the seed sector in selected countries, including Liberia. With support from the Government of Japan, AfricaRice is launching an emergency project to tackle the problem of insufficiency of rice seed in Guinea because of the Ebola crisis.

Meanwhile, remembering the quiet heroism of scientists in these countries, AfricaRice economist Ali Toure, who was working in Sierra Leone, remarked, "We are praying for the safety of our brave colleagues, who are continuing their work under very difficult and even dangerous situations."

As of 15 March 2015, 24,700 cases and 10,195 deaths had been reported worldwide, most of them in these three countries. The World Bank estimates that the regional economic toll could reach USD32 billion by the end of 2015.

Ms. Mohapatra is the head of Marketing and Communications at AfricaRice.

Maps

What kind of rice do consumers want?

An assessment of preferences of urban consumers in India and Bangladesh

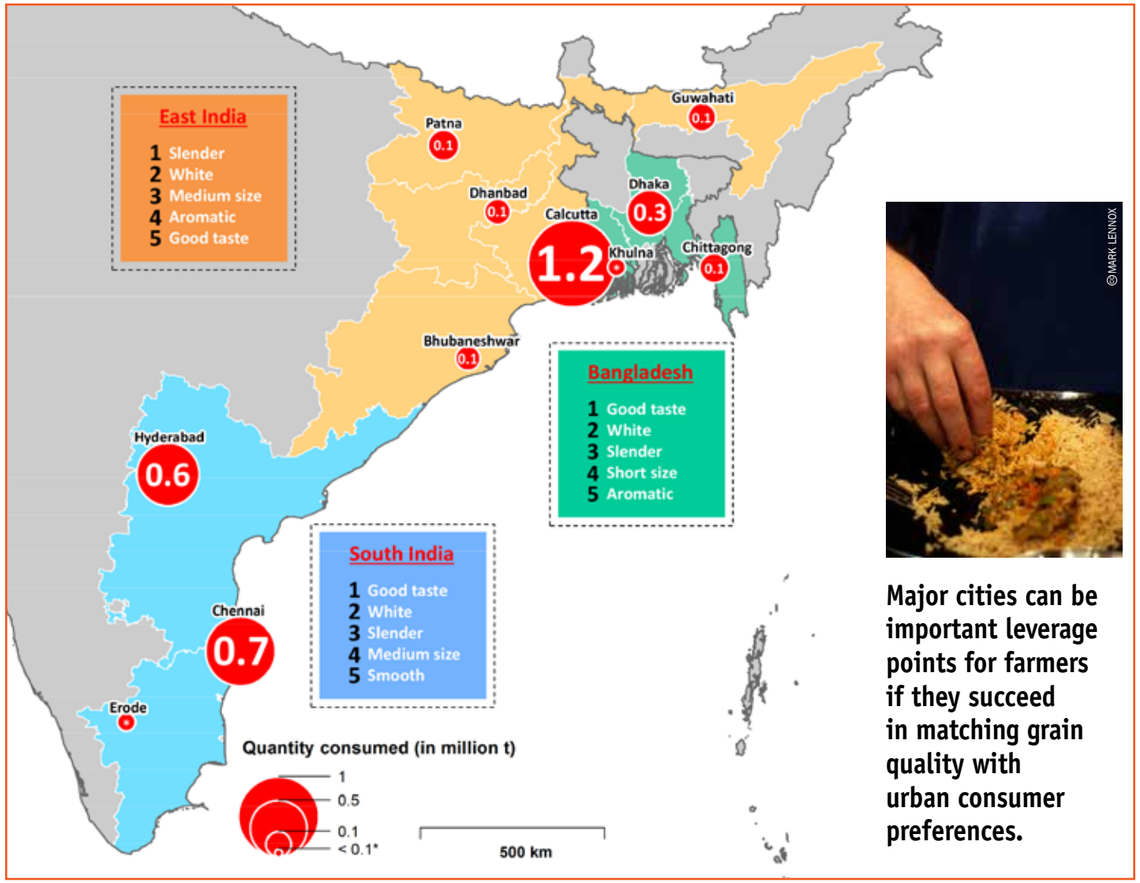
by **Marie Claire Custodio, Neale Paguirigan, Alice Laborte, Jhoanne Ynion,** and **Matty Demont**

About a third of the world's rice is produced and consumed in South Asia. By 2035, about 194 million tons[1] of rice will be needed to feed South Asians, about 40% of which will be consumed in urban areas[2]. Income growth, urbanization, and other socioeconomic transformations have affected consumption and preferences for food including rice. To understand the current rice preferences and have a basis for projections of future demand for rice quality, we interviewed 1,900 rice consumers in 11 major cities in East and South India and Bangladesh.

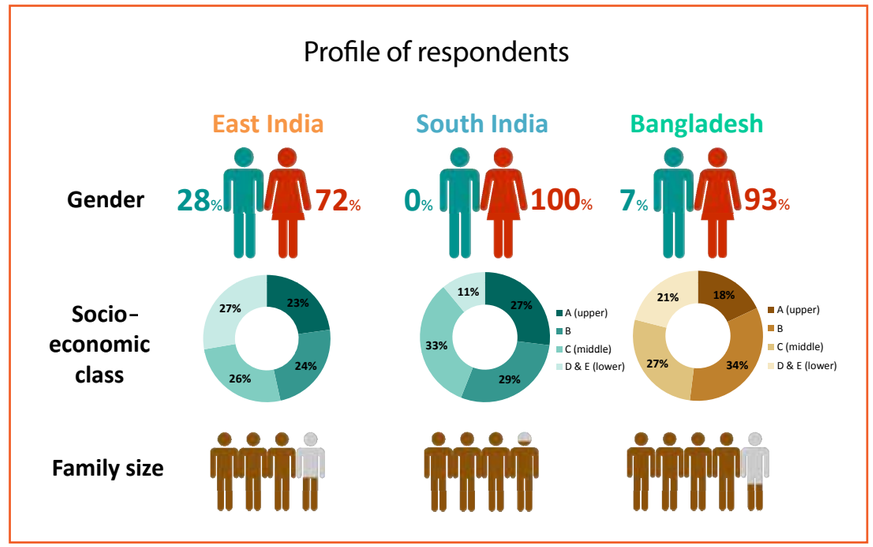
This is part of an on-going study by the Market Research Team at the International Rice Research Institute (IRRI) to understand market demand for rice quality traits and characteristics, and to contribute to the development of product profiles for a more targeted rice breeding program at IRRI and its national partners.

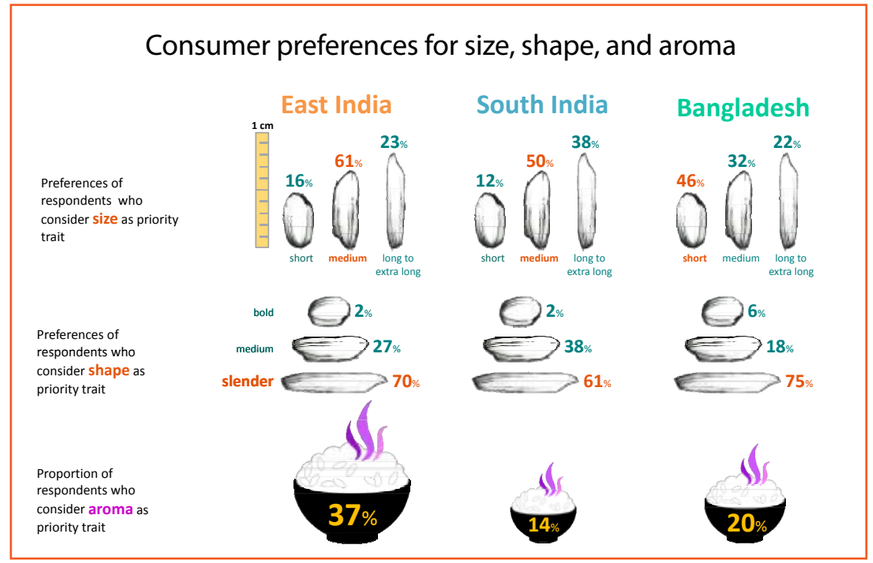
Our preliminary results are presented here.

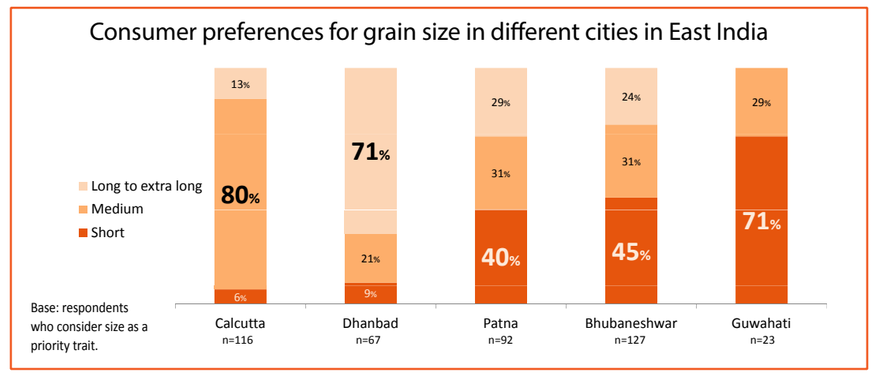
Dr. Laborte is a scientist and GIS specialist in the Social Sciences Division (SSD). Dr. Demont is a senior economist and leader of the SSD market and value chain research team, which includes Ms. Custodio, senior associate scientist; Ms. Ynion, assistant scientist; and Mr. Paguirigan, GIS and database management specialist.



Major cities can be important leverage points for farmers if they succeed in matching grain quality with urban consumer preferences.







[1]Source: IRRI Global Rice Model (2014)
[2] Source: http://faostat3.fao.org/download/O/OA/E

Striking a balance through ecologically engineered rice ecosystems

by **Finbarr Horgan, James Michael Villegas, Angelee Fame Ramal, Carmen Bernal, Alexandra Jamoralin, John Michael Pasang, Corazon Arroyo, Virginia Agreda,** and **Gregorio Orboc**

Planting flowering vegetable plants within a rice landscape offers farmers an environment-friendly way of controlling pests and diseases while improving their food security

HIGH-DIVERSITY vegetation patches on an ecological engineering farm in Bukidnon, Mindanao, Philippines.

As our truck bounces down the narrow muddy track toward the Alubog family farm in Colonia, Bukidnon, Philippines, a huge irrigation canal, charged by the recent heavy rains, roars beside the road. The morning sun is heating up, clearing the low-lying mist to reveal a strange new landscape: a cluster of towering green pillars like the neatly arranged leafy temples of an abandoned jungle city is punctuated across the farm. The structures have attracted the attention of local farmers and are intensely monitored by scientists from the International Rice Research Institute (IRRI) and the Philippine Department of Agriculture (DA) that regularly visit this corner of Mindanao.

These new structures, which first appeared in late 2013, are part of an effort to promote ecological balance in rice fields. Technically referred to as high-diversity vegetation patches, they offer refuge to a range of beneficial insects, spiders, and birds that protect the neighboring rice from hungry pests. The patches also provide farmers with fruits and vegetables, including okra, string beans, and bitter gourds that are consumed by the farming household or sold in the local markets.

High-diversity vegetation patches

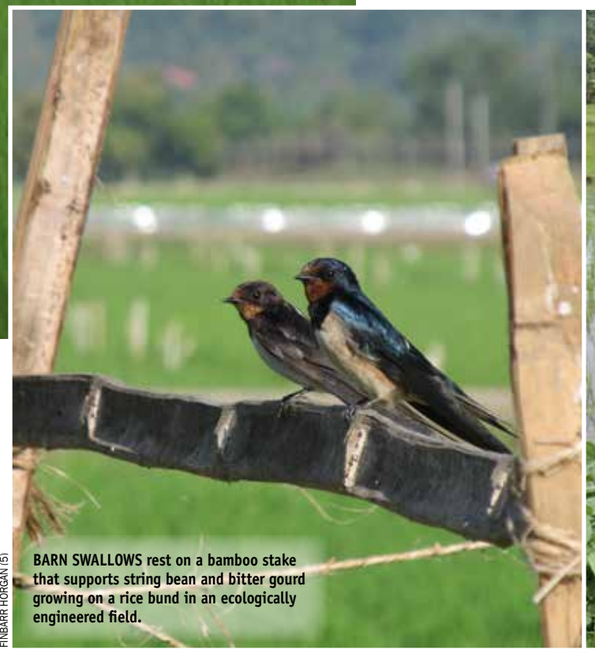
These patches were designed by IRRI and its partners at the DA. The initiative was funded by the DA-Bureau of Agricultural Research, with support from the Global Rice Science Partnership (GRiSP) and the German Ministry of Science and Education (LEGATO Project). The patches form part of the "tool kit" of ecological engineering—a rapidly growing discipline that attempts to create managed ecosystems with benefits for both people and nature.

The current patch design is the result of a series of trial-and-error experiments. Earlier work at IRRI had promoted the planting of flower strips on bunds to provide pollen and nectar for bees and parasitoid wasps, the latter being important enemies of formidable rice pests such as planthoppers and stem borers. With support from local governments, attractive rice landscapes with colorful flowered bunds have blossomed around Asia—particularly in Vietnam (see *Vietnam turns back a tsunami of pesticides* on pages 12-13 of *Rice Today* Vol. 13, No. 1). However, unlike bees, some farmers were not attracted to the flower strips, preferring to grow food or medicinal plants on their bunds.

The high-diversity vegetation patches were designed for farmers to grow the vegetables they wanted using the best combinations of plants and best configurations of patches to enhance biodiversity while reducing potential problems with rats and maintaining the original functions of bunds as water levees and pathways. IRRI scientists pay careful attention to the timing of flowering and the abundance of flowers produced by the different vegetable plants. For example, bitter gourd and cucumber are particularly prolific flower producers and are highly suited for the patches. Furthermore, the candidate vegetables had to be robust and tolerate the extreme conditions of rice bunds, which have large gradients of moisture and nutrients from top to bottom.

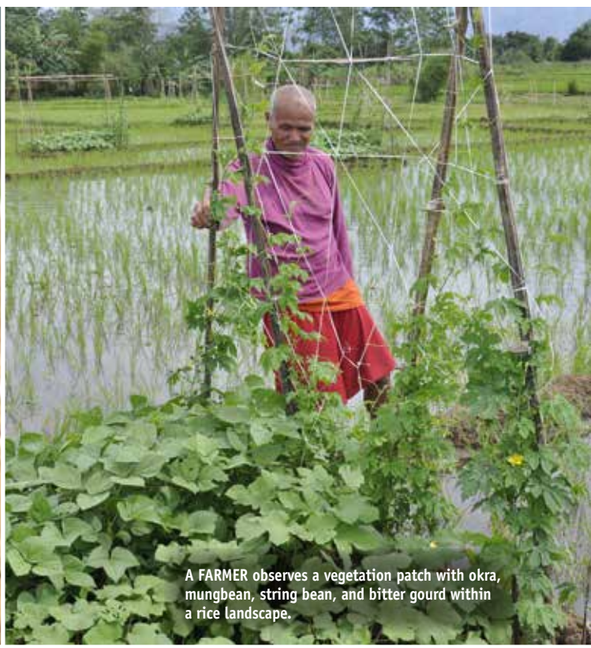
Responses from farmers and wildlife

In 2014, high-diversity vegetation patches sprouted up at several sites in the Philippines. And, Filipino farmers and neighboring wildlife responded



FINBARR HORGAN (5)

BARN SWALLOWS rest on a bamboo stake that supports string bean and bitter gourd growing on a rice bund in an ecologically engineered field.



A FARMER observes a vegetation patch with okra, mungbean, string bean, and bitter gourd within a rice landscape.

VEGETABLES PILED up on the table were produced in the high-diversity vegetation patches that can be seen interspersed among the ricefields in the background. The chemical-free vegetables and rice are highly sought after in local markets.

favorably. Results are surprising at the sites. Not only were the vegetable patches generally successful in attracting useful predators (such as spiders, lady beetles, and parasitoid wasps) and pollinators (such as bees and butterflies) but researchers also noted an increased abundance and activity of insectivorous birds.

Birds not often associated with rice fields, including barn swallows, pied trillers and long-tailed shrikes, could be seen actively searching among the rice plants for caterpillars and other insects. Three species of kingfisher used the patches as perching sites and one of these is the collared kingfisher, which actively consumed golden apple snails from the rice fields. Damage to rice from insects was generally low, and, where rice plants were attacked early in the season, pest populations were halted. The rice compensated well, giving good yields (3 to 6.7 tons per hectare in rainfed systems and 5.3 to 9 tons per hectare in irrigated systems during the dry season) by harvest time.

All this was good news—rice fields without the use of any pesticides could achieve up to 9 tons per hectare at irrigated sites. But one added bonus made this intervention even more attractive. Where vegetable husbandry was best, the small vegetable patches could produce more than 100 kg of string bean and okra and about 10 kg of mungbean for each 100 meters of planted bund. These fruits not only became an added source of food for the farmer participants in the study but were sought after at the local markets because they were chemical-free.

These experiences with ecologically engineered rice ecosystems indicate that balanced, healthy ecosystems can be productive and profitable. The little vegetable patches among the rice fields in Mindanao should remind observers that the most satisfying rice is that produced in harmony with nature.

Dr. Horgan is a senior scientist and Ms. Ramal, Ms. Bernal, and Mr. Villegas are researchers in the Crop and Environmental Sciences Division of IRRI. Their research aims at restoring ecological balance in rice ecosystems and reducing pesticide use. Dr. Jamoralin and Mr. Pasang are researchers at the Rizal Agricultural Station in Tanay, Rizal, Philippines. Dr. Arroyo is the manager and Ms. Agreda is a researcher at the Western Visayas Agricultural Research Station in Jaro, Iloilo, Philippines. Mr. Orboc runs the Regional Crop Protection Center in Bukidnon, Mindanao, Philippines.

NEIGHBORS BUY vegetables produced on high-diversity vegetation patches on a rice farm in Bukidnon.

INDIA REACHES THE PINNACLE IN RICE EXPORTS

by **Samarendu Mohanty**

CSISA

India has come a long way in the past 5 decades from a country with a severe food deficit to being a major grain exporter. The frequent food shortages in the 1950s and 60s and large-scale U.S. food grain assistance, especially wheat through the PL-480 program, seem to be a distant memory now. Growing up in the eastern state of Odisha, I vividly remember women and children lining up in front of my grandfather's house with a bowl in their hands to receive PL-480 wheat porridge for breakfast and lunch.

The Bihar famine in the mid-60s is regarded as a turning point for India's food production. As described in *The famine that India did not waste,* an article published in *Business & Economy,*[1] then Prime Minister Indira Gandhi realized the link between food sovereignty and independence in foreign affairs as the U.S. used its PL-480 food aid release to influence India's stance on American policy toward Vietnam.

Lester Brown, cofounder and president of the Earth Policy Institute in Washington, D.C., has a different take of the event. In *U.S.-India: Dealing with monsoon failure,*[2] he says the U.S. used the release of food aid during the Bihar famine to force the country to reform its food policy that served the urban population through a price ceiling to guarantee a floor price for farmers to encourage

[1] www.businessandeconomy.org/30092012/storyd.asp?sid=7042&pageno=1.
[2] www.theglobalist.com/us-india-dealing-with-monsoon-failure/.

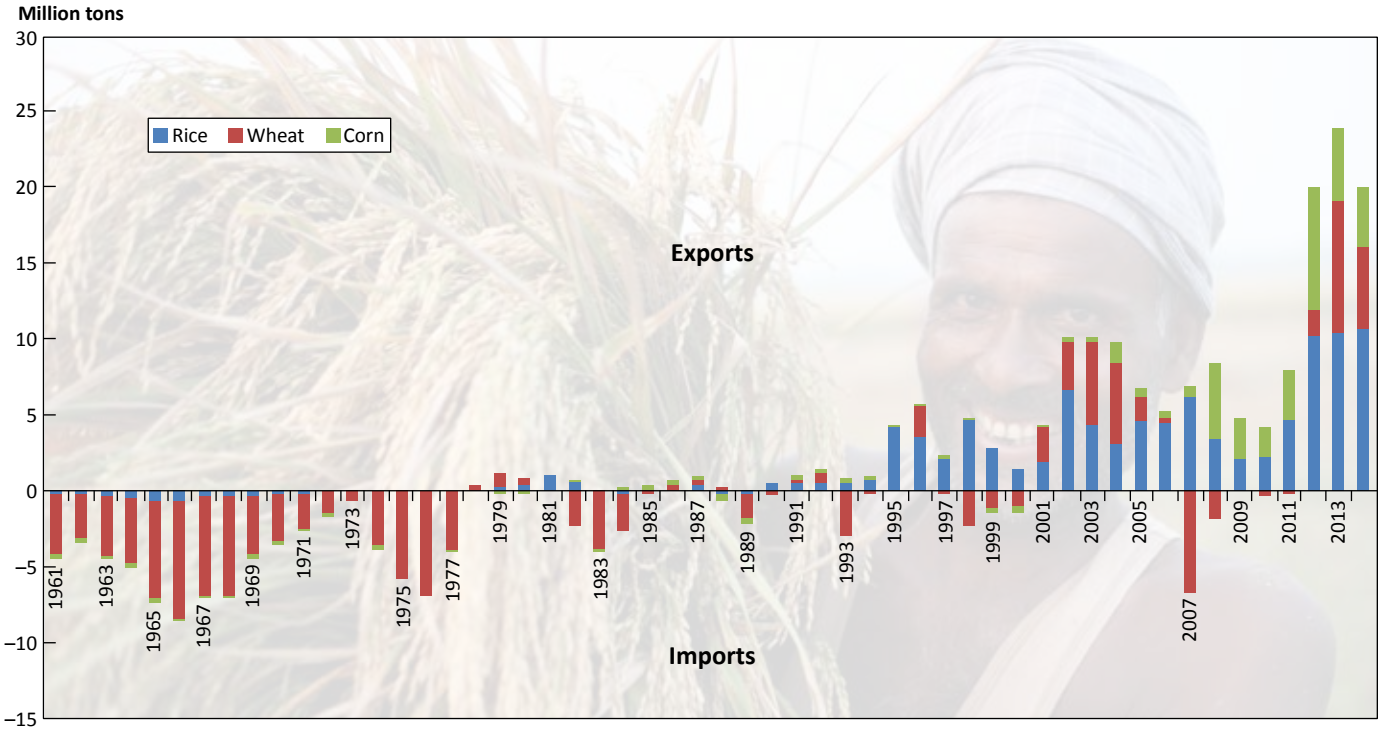


Fig. 1. India's transformation in grain trade, the shift from grain importing to grain exporting.
Source: Production, Supply, and Distribution (PSD), USDA.

food production. The U.S. President at that time, Lyndon Johnson, was worried that India was neglecting its agriculture and becoming too dependent on U.S. food aid to overcome its deficit.

Whatever the motive was, the end result has been more than satisfactory. Indian rice and wheat production in the past 5 decades rose by more than three- and eightfold, respectively. During this period, per capita availability increased by more than 10 kilograms for rice and 50 kilograms for wheat. The rise in grain production eventually transformed India from a grain importer to an exporter in the mid-90s (Fig. 1). Since then, grain exports (rice, wheat, and maize) have steadily increased, reaching 24 million tons by 2012-13. The transformation of the rice sector was even more startling, with India dethroning Thailand to become the largest exporter of rice in 2012. The Thai rice pledging scheme implemented in late 2011 definitely boosted India's rise to the top of the export chart, but India has continued to export in excess of 10 million tons even after the pledging scheme was removed in early 2014. Thailand edged past India in 2014 by exporting 10.97 million tons of rice after stopping the pledging scheme in 2014 as compared to 10.9 million tons for India (source: PSD, USDA).

Within rice, the biggest success has been the transformation of the basmati industry. Up until the early 1990s, Pakistan dominated the basmati market, but the rapid development of milling, processing, and packaging in the Indian basmati industry has made it the market leader today. In 2013-14, India exported around 3.76 million tons of basmati compared with 0.75 million tons of exports by Pakistan and earned a foreign exchange of nearly USD4.8 billion (source: Agricultural and Processed Food Products Export Development Authority or APEDA). During the same period, India exported 7.13 million tons of nonbasmati rice, primarily broken and parboiled rice, earning an additional foreign exchange of USD2.9 billion (source: APEDA).

The rising cost of success

There is no such thing as a free lunch. India spends billions of dollars on supporting its agricultural sector. The suite of policies it started in the mid-60s, that is, a minimum support price and input subsidies (for fertilizer, seed, water, electricity, machinery, among other inputs) for farmers and a food subsidy for the poor remain in place. These policies, without any doubt, played a key role in improving India's food security both nationally and at the household level but, at the same time, these policies have become a serious burden to the Indian exchequer. For the fiscal year 2015-16 (April-March), the central budget earmarked around USD20 billion for food subsidy and USD12 billion for fertilizer subsidy. On top of that, a few additional billions are spent on subsidizing credit, machinery, irrigation, power, and seed. These subsidies will continue to grow in the future if continued in its present form.

Another serious problem facing Indian rice production is the declining groundwater in its many rice-growing belts. In rice-growing states such as Punjab, Haryana, and Tamil Nadu, the free electricity and

the diesel subsidy have made the excessive withdrawal of groundwater worse. An article in *National Geographic*[3] stated that the water table in India is dropping at an average of 1.4 meter per year. If this trend continues, India's food security will be seriously affected in the future. Given the growing water problem in the country, Indian exports of 40 trillion liters of precious water annually—in the form of 10 to 11 million tons of rice—raises an important question of overproduction of rice in the country. On top of that, the 7 million tons of nonbasmati rice are normally exported at a price that hardly covers the true cost of production if you take into account the input subsidies (for fertilizer, electricity, seed, machinery, etc.) provided to the farmers.

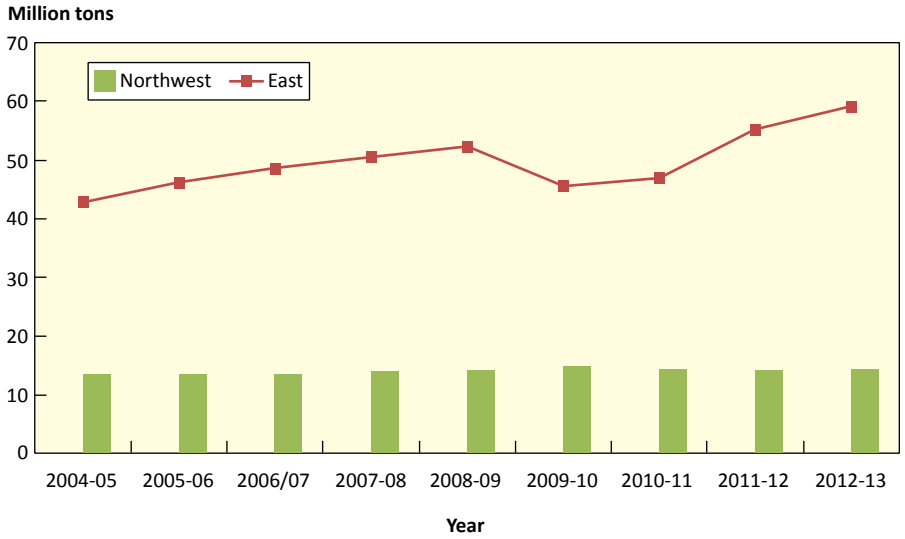


Fig. 2. Eastern vs northwestern India rice production.*
Source: www.Indiastat.com.

*Eastern India includes Odisha, Uttar Pradesh, West Bengal, Assam, Bihar, Chhattisgarh and Jharkhand; northwestern India includes Punjab and Haryana.

What needs to be done?

The reform of these subsidies, particularly for fertilizer and food, is long overdue. The current government clearly intends to tackle this "800-pound gorilla" that is so deeply rooted in the system. The government is seriously considering the recommendations of the Shanta Kumar Panel to deregulate the fertilizer sector and provide a cash subsidy of INR7,000 (around USD110) per hectare to farmers.[4] Similarly, the government is also looking into the panel recommendation to reform the grain subsidy program by implementing cash transfers in cities with a population of more than 1 million in grain-surplus states and an option for cash or physical grains in grain-deficit states.

In an attempt to reverse the increasing ground water depletion in major rice-surplus states such as Punjab and Haryana, and reduce pressure on these states to meet the country's food need, the government rolled out programs such as the National Food Security Mission and Bringing Green Revolution to Eastern India to improve the productivity of rice in eastern India. These efforts have resulted in some sizable increases in rice production in the eastern states in the past decade. The average yield of seven eastern states increased by more than 40% between 2004-05 and 2012-13 and production increased by 16 million tons (Fig. 2). During that same period, the rice area in Punjab and Haryana also increased slightly from 3.68 million hectares in 2004-05 to 3.87 million hectares in 2012-13, with production increasing by one million tons.

The recent trend suggests that the paddy yields in the eastern states will continue to rise in the future with greater use of quality seeds, flood- and drought-tolerant varieties, and improved production practices. There are no indications of shifting from rice in Punjab and Haryana into less water-intensive crops. The shift will not happen unless the government removes the minimum support price for rice or provides an assured price for alternate crops that will be equally or more profitable than rice in the region.

No one can deny India's success in food grain production and its transformation from a food-deficit country to a major grain exporter in the world. What India did to achieve this milestone was to meet the need of the hour to spare millions from starvation and poverty. But, the time has come to think beyond just the quantity of grain production and more along the line of sustainability of the production system, including the cost of subsidies. Reforms of food and input subsidies will not be easy but this needs to be done at the earliest. As eastern India expands its rice production to take care of the country's food needs, the state governments in Punjab and Haryana, with the help of the central government, should devise a strategy to reduce their area under rice, particularly nonbasmati rice, to relieve the pressure on groundwater.

Dr. Mohanty is the head of the Social Sciences Division and program leader (Targetting and policy) at the International Rice Research Institute.

[3] http://voices.nationalgeographic.com/2015/02/03/indias-food-security-threatened-by-groundwater-depletion/.
[4] http://articles.economictimes.indiatimes.com/2015-03-02/news/59683948_1_direct-cash-subsidy-lpg-subsidy-grain-distribution.

The outstanding India-IRRI partnership

BY M.S. SWAMINATHAN

At the time of establishing the International Rice Research Institute (IRRI) in 1960, Dr. Sterling Wortman of the Rockefeller Foundation seriously considered India as a potential location for IRRI. However, Los Baños in Laguna, Philippines, was chosen as the main location for IRRI based on many factors.

Jose Drilon, IRRI's first executive officer, and Arturo Tanco, Philippine Agriculture Secretary, played key roles in getting IRRI established in the Philippines. This has been fortunate since the Philippines has been an excellent host and has also provided high-quality human resources for the Institute, apart from land and other facilities.

I visited IRRI for the first time in 1964. I was greatly impressed with the germplasm in the field, with emphasis on a new plant architecture, which could make use of soil nutrients and water most effectively. There was also great emphasis on breeding varieties resistant to major pests and diseases. Therefore, I strongly recommended to the Government of India to enter into a mutually beneficial partnership with IRRI. The Institute also invited Indian visionaries such as K.R. Damle, then Secretary of Agriculture, to serve on its first Board of Trustees in 1960.

During the *International Rice Year 1966*, the Government of India honored Robert Chandler, the founding director general of IRRI, with the International Rice Prize. Since then, the relationship between the Indian Council of Agricultural Research (ICAR) and IRRI has been strong, mutually beneficial, and a proven model for symbiotic partnerships among research institutions.

ICAR and IRRI started developing memoranda of understanding and annual work plans in order to provide structure and purpose to the partnership. In association with the Rockefeller Foundation, ICAR also established an All India Coordinated Rice Improvement Project (AICRIP) with headquarters in Hyderabad in 1965. This provided an opportunity for a more targeted relationship with IRRI. In 1966, AICRIP received from IRRI a set of 300 strains of rice containing genes for resistance to pests and diseases and possessing a nonlodging plant architecture. Varieties developed at IRRI have been used in the hybridization program in AICRIP.

Another important contribution of IRRI has been in human resource development. A wide range of researchers, including senior scientists and postdoctoral fellows, were given opportunities to visit IRRI and work at the Institute for some time with appropriate counterparts. Several PhD scholars completed their course work at the Indian Agricultural Research Institute (IARI) and other institutions in India and conducted their research work at IRRI.

The exchange of genetic material between IRRI and AICRIP was also intensified. In 1981, IRRI delivered cytoplasmic-genetic male sterile (CMS)[1] rice lines to India. IRRI converted Pusa 167-120-3-2 into a CMS line (IR58025 A). This became an important source for hybrid rice breeding. India also used high-yielding and disease- and pest-resistant IRRI varieties such as IR20, IR22, IR26, and IR72, among other varieties, in the Indian rice breeding program. IR36 and IR64 are still very popular among Indian farmers. IRRI also identified the *Xa21* gene for bacterial blight resistance in wild rice (*Oryza longistaminata*), which was sourced from India. Also, IRRI and India saw potential in FR13A, a flood-tolerant rice variety grown in limited areas of eastern India from which the famous *SUB1* gene was ultimately identified. Scientists from IRRI and India have published several joint papers.

The IRRI-India partnership has been an outstanding exercise in promoting collaboration, which advances global rice science and development on the one hand and India's rice production on the other. Because of its symbiotic nature, this partnership has not only endured, but has been enriched over the past half century. I am pleased that this issue of *Rice Today* is chronicling a remarkable example of the power and value of partnership between CGIAR institutions and national agricultural research and extension systems.

Dr. Swaminathan is the founding chairman of the M.S. Swaminathan Research Foundation. He is a former IRRI director general (1982-88) and is known as the father of the Green Revolution in India.

[1] CMS is a condition of inablity of a plant to produce functional pollen. It is an important tool in hybrid seed production. Hybrids often exhibit heterosis or hybrid vigor, whereby the traits of a hybrid progeny are enhanced as a result of the genetic combination of its parents.

The enduring India-IRRI relationship

BY J.K. LADHA

As documented in this issue of *Rice Today*, India and IRRI have had a very successful relationship over the decades. The introduction of rice variety IR8, which helped save India from a massive famine in the 1970s, marked the true beginning of the success of the partnership. Then, some remarkable results followed such as the development of more than 400 disease- and insect-resistant rice varieties, hybrid rice varieties bred through public and private sector programs, streamlined rice production practices, and improved postharvest technologies for better sustainability and productivity.

Both ICAR and IRRI have trained scientists, providing equitable access to information, and conducting socioeconomic research. India has been actively part of IRRI's priority setting, strategic planning, providing scientific advice, and carrying out research work in the region. Senior Indian scientists and government officials have served almost continuously on IRRI's Board of Trustees since its creation. Indeed, the partnership has achieved outstanding results—setting a gold standard in international research collaboration.

As the India-IRRI collaboration has matured, so have the needs, expectations, and environment of doing business in relation to what is happening not only in India but also regionally and globally. India has a strong national rice research program and has increasing participation by the private sector and civil society organizations. IRRI should not take over functions that the public or private sector should have in the country. Our comparative advantage is strong in science and innovation, looking at the "big picture," training in frontier areas, and catalyzing the transfer of new technologies to those in the value chain.

Also, we should maintain or even increase our leadership, physical presence, and impact in strategic regions of India where rice is the predominant crop. Considering this, we should play a key role in revolutionizing the rice sector, particularly, in eastern India.

With the establishment of a new regional rice hub in Hyderabad and in close collaboration with ICAR and other public and private sector institutions, the India-IRRI partnership can assist countries in South Asia and Africa in strengthening their rice programs. This would allow us to implement the upstream research agenda agreed upon under the India-IRRI collaborative research program. This includes targeted breeding research and training programs that will benefit other South Asian Association for Regional Cooperation member countries.

India, with its large diversity of soil and climate, provides unique opportunities to develop situation-specific rice varieties that will also be relevant to its neighboring countries.

Although our work will continue to focus on trait and varietal development with many abiotic stresses (drought, submergence, salinity) and biotic stresses (sheath blight and other diseases), we also need to initiate research on emerging problems such as false smut, nematodes, and low-light intensity. Shorter-duration rice, which can fit in diverse cropping systems, should continue to be a priority. The demand for good grain quality is increasing along with the rising purchasing power of a significant sector of rice consumers. With emerging labor shortages and rising labor wages, we need to focus on conservation tillage and direct seeding of rice. We need to conduct agronomic systems research and develop best management practices for key rice systems.

We should aim to maximize the yield potential of new varieties. There is a strong need for technology targeting and the development of extrapolation domains for an efficient uptake of new technologies. Although most research themes and activities will cut across all the top-10 rice-growing states of India, relative priority will differ.

As we continue our strong partnership with ICAR, the Department of Agriculture and Cooperation, and state agricultural universities, we should develop linkages with India's seed industry. The country has a vibrant seed industry with many large and small players. Some seed companies have a very active R&D and breeding program, which includes hybrid rice. IRRI should play a major role in trait discovery and in the development of a new generation of parental lines and varieties, including hybrids, for small and large seed companies that meet consumer preferences and are adaptive to rainfed ecosystems.

Institutions like IRRI increasingly face funding constraints and have to work on their goal of full cost recovery. We should continue to explore additional and new project funding, including philanthropic donations and grants from Indian donors.

Dr. Ladha is principal scientist and IRRI representative for India and Nepal.

Creating the Future
SATAKE

Indonesia's on the Grow

Indonesia with its 245 million population

(*1) is not only the 4th largest country in terms of population. It is also known as the 3rd largest paddy producer in the world (*2), as well as the largest importer of rice, too (*3).
With the country' s population set to grow, rice millers in the country are expecting a huge growth in the rice consumption.
P.T. Lumbung Padi Indonesia is one of them, and has recently set up a modern rice milling facility to meet this demand. The rice mill has a capacity of 15 tons per hour paddy input capacity. However, the rice mills uniqueness lies not only with its capacity.
It has also adopted the latest processing systems from dryer to final packing in order to supply the highest quality rice to the market.
Satake has been responsible for the complete plant design. Satake has also set up a new joint venture company in Surabaya, the aim of which is to provide its Indonesian customers with the highest standards of technical support services. (P.T. Satake Gobel Indonesia).

*1: 2013, IMF "World Economic Outlook Databases"
*2: 71.2 million tons, FAOSTAT 2013
*3: 2.7 million tons, FAOSTAT 2011

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