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Creating an oasis with rice

Climate-smart rice for Africa
Bitter harvest from a noble cause
Where Latin America's rice gets a baptism of fire

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contents

RiceToday Vol. 13, No. 2

About the cover. Prabhawati Devi, a rice farmer from a small village in eastern Uttar Pradesh, proves that determination and knowledge create a force powerful enough to defeat droughts and even break the chains of poverty. Using a drought-proof rice variety and modern cropping practices, Mrs. Devi has become not only a highly successful farmer, more importantly, she is an inspiration to the other women in her village who have been compelled by circumstances to take on the roles performed traditionally by men. (Photo by Lanie Reyes)

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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The opinions expressed by columnists in *Rice Today* do not necessarily reflect the views of IRRI or GRiSP.

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From the editor's desk

Shortly before this issue of *Rice Today* went to press, the agricultural world celebrated, on 25 March, the 100th birth anniversary of Norman Borlaug, the legendary scientist and 1970 Nobel Peace Prize winner. He developed the high-yielding semidwarf wheat varieties that jump-started the Green Revolution for that crop starting in South Asia in the 1960s. It was my honor to work with Norm during the late '80s and early '90s when I was a communicator at the International Maize and Wheat Improvement Center (CIMMYT) in Mexico.

This great man is a hero to all of us who had the privilege of knowing him. One of those people, Robert Zeigler, director general of the International Rice Research Institute (IRRI), points out that Dr. Borlaug saw the Green Revolution in Asia and elsewhere as a means to buy us all time to stabilize populations and generate the knowledge that would allow us to support ourselves worldwide without destroying the environment. Now, Dr. Zeigler frets that too many anti-technology zealots who claim to defend the environment and the interests of the poor are causing a major distraction to making progress by attacking the achievements of Borlaug and his contemporaries. Read Dr. Zeigler's frank analysis, *Bitter harvest from a noble cause*, on pages 36-37.

As *Rice Today* continues to emphasize the importance of women in agriculture, our cover story features Prabhawati Devi, a strong-spirited farmer in India's eastern Uttar Pradesh who is creating her own oasis in a droughty landscape (pages 10-12). Moving to Senegal, the county's mother of modern rice farming, Peinda Cissé, tells an inspiring story in her own words (pages 38-39). And, no one has been more involved in blazing the trail of empowerment for women than IRRI's own Thelma Paris, who is retiring after 40 years as a gender specialist at the Institute. Her achievements and contributions are simply phenomenal (pages 18-19).

Congratulations to the researchers in the Stress-Tolerant Rice for Africa and South Asia (STRASA) project, which has been given the go-ahead by the Bill & Melinda Gates Foundation for a third phase (see News on page 5). It is STRASA technology that is empowering women farmers such as Prabhawati Devi, whom I mentioned above. Later in April, I look forward to traveling with STRASA coordinator Manzoor Dar to West Bengal in eastern India to see first-hand how this project is transforming the lives of the poor farmers of the region. Stay tuned for my report in a future issue. On STRASA's African front, see *Climate-smart rice for Africa* on pages 30-31, which chronicles the project's impressive impact to date in 18 countries across the sub-Saharan part of the continent.

Also from India, we have the latest on the ground-breaking National Food Security Act (page 43) and then add a rice folk tale from Nagaland in the northeast (pages 26-27) and a birthday bash for rice itself in Kerala on the southwestern tip of this culturally rich country (pages 34-35).

For lovers of gastronomy and cartography, we turn to Bangladesh. Check out *What's cooking* on page 13—it's *Bhuna khichuri*, a highly nutritious dish featuring rice and protein-rich pulses. Then see how IRRI and the Ganges Basin Development Challenge Program of the CGIAR Challenge Program for Water and Food are mapping regions of opportunity and high potential in the coastal areas (pages 20-21).

Moving to another part of Asia, Bruce Tolentino, IRRI's deputy director general for communication and partnerships, points out that the 10 member countries of the Association of Southeast Asian Nations (ASEAN) are crucial to global food security and how the Global Rice Science Partnership (GRiSP) can help the region attain its rice productivity and quality goals. Read his analysis on pages 15-17.

In Latin America, read about how the region's rice varieties must first survive a baptism of fire at Colombia's remote Santa Rosa Experiment Station before becoming worthy of being planted in farmers' fields (pages 24-25).

In a major transition at IRRI, Achim Dobermann, the Institute's deputy director general for research since 2008, departed in February, leaving behind a remarkable legacy of achievement. He truly put rice research on the global agenda. Read all about his time at IRRI on pages 28-29. Replacing him at the helm of IRRI's innovative research program is Matthew Morell, who has led research at Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) for the past 16 years (see News on page 5).

And, welcome aboard to two new *Rice Today* editorial board members, Matthew Morell, who replaces Achim Dobermann, and Eduardo Graterol, the new executive director of the Latin American Fund for Irrigated Rice (FLAR).

Happy reading!

Gene Hettel
Rice Today editor-in-chief

New head of research at IRRI

Matthew Morell was recently appointed as deputy director general for research at the International Rice Research Institute (IRRI). As the research leader, Dr. Morell provides strategic leadership and oversight for IRRI's research and outreach programs on genetic diversity and gene discovery, varietal improvement, genetics, biotechnology, crop and environmental sciences, crop management, grain quality, postharvest and mechanization, targeting and policy, and training.

He has extensive experience in identifying, protecting, and managing intellectual property, as well as establishing a means for strong compliance with the requirements of gene technology regulations, genetic modification stewardship, and occupational health and safety legislation. The Australian native brings to IRRI years of experience, including 16 as theme leader at the Commonwealth Scientific and Industrial Research Organisation. He is driven by a passion for scientific excellence, an understanding of private-public partnerships, a sound capacity for stakeholder engagement, a tested understanding of identifiable patent outcomes and protection of intellectual property, and people engagement and leadership skills.

Source: IRRI

GENE HETTEL

STRASA project to tackle new challenges into 2019

The Stress-Tolerant Rice for Africa and South Asia (STRASA) project is soaring to new heights with the start of its phase 3 for a five-year period, as approved on 4 March 2014 by the Bill & Melinda Gates Foundation (BMGF). In announcing the extension, Gary Atlin, BMGF senior program officer, congratulated the STRASA teams in Asia and Africa on their success and thanked the project's leadership for its perseverance.

Abdelbagi Ismail, overall STRASA project leader, said, "I am sure the next five years will be even more exciting with even greater success and impact."

Starting in late 2007, STRASA, coordinated by the International Rice Research Institute in Asia and the Africa Rice Center in Africa, was created to develop and deliver rice varieties tolerant of flood, drought, and other abiotic stresses to at least 20 million farmers in the unfavorable rice-growing environments in South Asia and sub-Saharan Africa. Read about STRASA's success in Asia on pages 10-12 and in Africa on pages 30-31.

Source: strasa.irri.org

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Prominent rice breeder tells Punjabi farmers to grow more vegetables and fruits

With the underground water table declining, international rice breeder Gurdev Khush recently asked Punjabi farmers in India to consider cutting down on the area they plant to water-guzzling rice and switch over to other cash crops. Punjab-born Khush, who has won several awards for his rice breeding work, including the 1996 World Food Prize, said, "We cannot completely get out of rice, but we should reduce some of the area grown to the crop. We have to diversify into crops such as vegetables and fruits, which are suitable for planting in Punjab."

There is a great demand for vegetables in the Middle East, Europe, and elsewhere, so farmers should consider planting them. Indeed, even in India itself, an ever-growing middle class is demanding access to more vegetables and fruits (see *Grain of Truth* on page 43).

Dr. Khush pointed out that, even though researchers are working with farmers to reduce water consumption, overexploitation of underground water by Punjabi farmers to grow their rice is resulting in a critically low level of the water table in several blocks of Punjab.

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During his 35-year career at the International Rice Research Institute, Dr. Khush spearheaded the development of high-yielding disease- and insect-resistant rice varieties, which ushered in the Green Revolution. More than 300 rice varieties developed under his leadership have been released in Asia, Africa, and Latin America.

Source: Business Standard

44 new rice varieties in Asia and Africa

The International Rice Research Institute (IRRI) and its partners released 44 new and improved rice varieties in 2013. Of these, 21 were in the Philippines, six in Bangladesh, five in Myanmar, three in Nigeria, two in Tanzania, two in India, and one each in Cambodia, Vietnam, Indonesia, Mozambique, and Rwanda.

"We are excited over these varieties, especially those released in Nigeria," said Dr. Glenn Gregorio, senior rice breeder at IRRI. "These are the fruits of many years of collaboration that I have personally been a part of during my posting at the Africa Rice Center station in Nigeria. IRRI worked hard and closely with national breeding programs, and we know that this will lead to more collaboration as demand for rice increases in sub-Saharan Africa."

The new varieties represent IRRI's continuing decades-long mission of using rice science to reduce hunger.

"Overall, IRRI has released around a thousand improved rice varieties across 78 countries since its establishment in 1960," said Dr. Eero Nissila, head of IRRI's breeding division. "These are considered global public goods. Hence, our partners are free to release these for farmers' use or for more breeding work to suit local needs in their countries."

Source: IRRI

Regional rice strategy set to boost production and livelihood of farmers

Faced with growing threats to rice production, countries in Asia and the Pacific are engaging in a regional rice strategy, initiated by the Food and Agriculture Organization (FAO) last year at the request of member states. The strategy's vision for the rice sector is that of "food-secure, better-nourished, and prosperous rice farmers and consumers in the Asia-Pacific region who benefit equitably from a vibrant, innovative, and transformed rice sector that is more productive, efficient, and environmentally sustainable by 2030."

The strategy aims to provide evidence-based strategic guidelines and options for FAO member states in the region to help them develop and adjust their own national rice policy strategies in the light of broader regional and global trends as well as national priorities, according to Hiroyuki Konuma, FAO assistant director general.

According to the regional rice strategy, there is cause for concern about the feasibility of dramatically increasing rice production because of a lack of water and/or arable land in many countries of the region. But rice could play an important role in ensuring food security by reducing hunger, malnutrition, and poverty. That's a strong incentive leading to developments in science and technology to increase rice productivity in a sustainable way, add nutritive value to rice, reduce losses from drought and flood, and reduce the environmental footprint of rice production.

Source: FAO

Women farmers in sub-Saharan Africa receive support

Women produce up to 80% of the foodstuffs for household consumption and sale in local markets in sub-Saharan Africa, according to a report by the World Bank and the Food and Agriculture Organization. For crops such as rice, wheat, and maize, which make up about 90% of the food consumed by rural dwellers, it is women who mostly sow the seeds, do the weeding, cultivate and harvest the crops, and sell surpluses. Despite the role and impact of women in African agriculture, there's still an unsettling disparity in the support they receive compared with men and they have remained largely in the background, receiving little help.

Fortunately, the future is bright for women farmers. They are benefiting from more training opportunities, incentives, and other programs designed to equip small-scale women farmers with information, skills, and other inputs to improve crop quality and quantity. In Tanzania, the Bill & Melinda Gates Foundation is providing women farmers with training that tackles gender-related norms and attitudes that discourage women from engaging in coffee production. These farmers learn how to improve coffee quality and quantity, which in turn increases their income. The Alliance for a Green Revolution in Africa has teamed up with Tanzania's agriculture ministry to launch the Integrated Soil Fertility Management program to promote improved soil health through intercropping cereals with legumes. Under this program, women receive information on soil fertility through community radios, mobile phones, and agricultural extension workers.

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Source: www.dailynewsegypt.com

Women's farm roles key to food sufficiency in Burundi

Hon. Ir. Odette Kayitesi underscored the crucial role of women in farming and the increasing demand for rice in her country during a visit to the International Rice Research Institute (IRRI). "Women play a valuable role in the fields," Minister Kayitesi said. "With improved farming practice, rice can help address the challenge of food security in Burundi."

The minister commended IRRI for its dynamic work and important role in changing the lives of ex-combatant women who are now fighting a different battle—food insecurity in Burundi. Rice is one of the government's priority crops, seen to contribute greatly to food security in the country. Minister Kayitesi said that the government strongly supports building further on the collaboration between IRRI and Burundi, improving the region's rice production, and supporting the fight against poverty and hunger. In anticipation of a stronger collaboration, new laboratories will be built and new scientists trained in agronomy, social sciences, plant pathology, and corporate services to strengthen rice research and production in the region.

In January 2013, Burundi's Minister of External Relations and International Cooperation Hon. Laurent Kavakure signed an agreement with IRRI Director General Robert Zeigler to further promote and accelerate rice research and rice-based cropping systems. This led to the opening of IRRI's East and Southern Africa (ESA) Regional Office in Bujumbura in October 2013 that now serves as a regional rice research hub that will help support the development of the rice sector in Africa, and strengthen national and regional rice research and production programs. The government granted IRRI the use of a 10-hectare plot of land in Gihanga for rice research.

Source: IRRI

Tackling youth unemployment through agriculture


R RAMAN, AFRICARICE

Many experts have expressed alarm over Africa's growing youth unemployment. Ibrahim Mayaki, chief executive officer of the New Partnership for Africa's Development, calls youth unemployment a "time bomb." Sub-Saharan Africa's youth population is increasing rapidly, with the 15- to 24-year-old age group at 200 million, a figure that is expected to double by 2045, according to population experts. But agriculture could potentially provide enough food and jobs.

Marco Wopereis, Africa Rice Center deputy director general, says that innovations in agriculture could unlock vast employment opportunities. The rice sector alone has the potential to employ many of the 17 million young people who enter the job market in sub-Saharan Africa each year. With financial support and training programs, young rice farmers could boost rice production and add value to it, indicated Dr. Wopereis: "With so many people without a job, the rice sector in Africa is a golden opportunity to provide jobs."

Source: http://allafrica.com

Rokupr Rice Research Center re-emerges as a center of excellence

The Rokupr Agriculture Research Center in Kambia, established in 1934 as an institute to do research on mangrove rice seed multiplication, received US$10 million in funding from the government of Japan, through the West Africa Agricultural Productivity Program and the Rural and Private Sector Development Program.

During the last season, the center focused on carrying out core research programs focusing on mangrove rice. The center promotes improved seedlings and advises farmers on the use of the variety of rice seeds available on-site. Feedback from farmers indicates that the center's research activities have greatly improved their production and yield.

Source: http://awoko.org

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SELECTED TRAINING COURSES AT IRRI

Course title	Date	Venue
SNP Data Analysis	5-9 May	IRRI, Philippines
Rice: Research to Production	19 May – 6 June	IRRI, Philippines
Research Data Management	20-22 May	IRRI, Philippines
Basics of Rice Production: Rice Camp for Teachers	25-27June	IRRI, Philippines
Regional Group Fellowship on Phenotyping and Integrated Plant Mutation Breeding with Best Fit Soil and Water Management Practices for Climate Change Adaptation	1-28 July	IRRI, Philippines
Rice Production Techniques for Research Technicians *(Targeted for African participants)*	28 July–15 August	IRRI, Philippines
Research Data Management	26-28 August	IRRI, Philippines
Molecular Breeding Course	22 September–3 October	IRRI, Philippines
Rice: Postproduction to Market *(Second offering)*	13-24 October	IRRI, Philippines
Research Data Management	21-23 October	IRRI, Philippines
Basics of Rice Production *(Second offering)*	28-30 October	IRRI, Philippines

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Note: Fees and schedules are subject to change without prior notice.

RiceToday around the world

HOLY ZEE! Flanked by two Swiss Guards, IRRI Director General Robert Zeigler displays an appropriate *Rice Today* cover during a break in the meeting of the Working Group on Bread and Brain, Education and Poverty at the Pontifical Academy of Sciences in Vatican City.

IVY AND RICE. While Elizabeth Earle, professor in the Department of Plant Breeding and Genetics at Cornell University's College of Agriculture and Life Sciences, works on genetic improvement of crops, her Ivy League colleague Bruce Lewenstein, professor of science communication, makes sure the public understands and appreciates the work of scientists like her—a common mission with *Rice Today* magazine.

RICE IN PARADISE. Dr. Keiichi Hayashi (*left*), Climate Change Adaptation in Rainfed Rice Areas (CCARA) project coordinator, and Dr. Hirofumi Sakuma from the Research Institute for Global Change of the Japan Agency for Marine-Earth Science and Technology, enjoy a side trip to the rice terraces of Bali. The famed island paradise in Indonesia hosted the 3rd annual review and planning of CCARA, an IRRI-Japan Collaborative Research Project.

MICHAEL PURUGGANAN, Dorothy Schiff Professor of Genomics and Dean of Science at New York University, with a *Rice Today* issue that carries a reprint of his article on debunking Golden Rice myths.

Creating an oasis with rice

Story and photos by **Lanie Reyes**

Under the scorching sun and cloudless skies, farmer Prabhawati Devi builds her oasis using a rice variety that defies the drought that often parches her land

A car can usually travel down the narrow concrete road in Nagwa Village of Maharanjganj District in eastern Uttar Pradesh. However, during this second week of November—harvest time in the fields surrounding the village—piles of rice straw clogged the way, making passage virtually impossible.

Most of the women, including Prabhawati Devi, were busy cutting the straw and piling it neatly on jute sacks that were cut open to serve as mats for the straw. As she was gathering the edges of the stalks, Mrs. Devi said with a smile, "These are Sahbhagi." Sahbhagi is what the farmers and villagers call Sahbhagi dhan, a drought-tolerant rice variety released in India in 2009 (see *Making rice less thirsty* on pages 12-15 of *Rice Today*, Vol. 8, No. 3). The straw of Sahbhagi dhan is popular among the women in Nagwa, who feed it to their cattle.

PRABHAWATI DEVI shows her newly harvested Sahbhagi dhan, a rice variety that assures her of a harvest even when drought strikes.

It's a woman's life

Brick and mud houses, scattered along the road of Nagwa, are not big enough to shield from view the residents inside as they go about their daily chores. One woman was cooking just inside her front door, squinting under the almost-midday sun and shielding her eyes with her hands from the smoke of the burning fuelwood.

Outside her house, another woman was threshing rice manually—raising her arms as high as she could as she smashed a bunch of rice stalks on a surface covered with fine mesh net. She gathered the separated grains with her hands, placing the grains at the center of the net and putting the empty stalks neatly to her side. She rose once in a while to straighten her back from her squatting position. Yet another woman had just returned from harvesting rice bundles in the field. Women often harvest rice in staggered shifts because they want to give the fresh rice stalks to their cattle.

Nagwa looked like a village of women in a flurry of activities. Their bright saris made them more visible under the bright, scorching sun.

"As more men migrate from rural areas to the cities to look for 'greener pastures,' women then take on the farming activities that the men leave behind," commented Abha Singh, an associate scientist based in Faizabad, eastern Uttar Pradesh. She is one of the many women who Thelma Paris, a gender specialist recently retired from the International Rice Research Institute (IRRI), took under her wings (see *Blazing the trail of women's empowerment* on pages 18-19).

An all-or-nothing gamble

In eastern Uttar Pradesh, where rice production is predominantly rainfed, growing rice is so risky that farmers take a gamble every cropping season and can only hope for the best. They have no choice but to place their bet. When luck is on their side, during a year with ample rainfall, the farmers are blessed with enough food to sustain their families till the next cropping season. But, when drought strikes, the price of crop failure means losing all their investments—labor, seed, and inputs—and long, lean, hungry months ahead.

"The eastern part of India was considered a 'hunger belt' that is why IRRI started working on the dissemination of stress-tolerant rice varieties in 2008 through the Stress-Tolerant Rice for Africa and South Asia (STRASA) project," said Umesh Singh, STRASA's regional coordinator. In 2007, Dr. Singh, along with other IRRI scientists, successfully convinced the Bill & Melinda Gates Foundation that this project would provide much-needed assistance to these farmers.

"The project aims to develop rice varieties that can withstand flood, drought, and salinity, among other stresses brought about by climate change," he added. "We call these new varieties climate-smart rice."

STRASA researchers evaluate these varieties, including participatory varietal selection (PVS) involving farmers. Gender is integrated into most activities under STRASA and the Global Rice Science Partnership (GRiSP), the CGIAR Program on Rice, that aim to give women farmers input into the selection of improved rice varieties that are approved for release. It also helps in creating awareness among the farmers even before the formal release of a variety. This participatory varietal selection process, modified by Dr. Paris and her research team, initially required that women make up at least 30% of the participating farmers. Women's participation will hopefully increase to 50% in the next phase.

"STRASA works with the national research partners to get the varieties released and notified for commercial cultivation," explained Dr. Singh. "It also works closely with the developmental organizations including federal and state governments for the outscaling of new varieties."

A refuge of a woman farmer

Women farmers such as Mrs. Devi are benefiting greatly from STRASA. Her concrete house has sturdy concrete posts; its blue paint faded just slightly, hinting that she has lived there for just a short time. As I made myself comfortable on a wooden stool, I noticed a gathering crowd of women, children, and some men blocking the natural light coming in from the door. Mrs. Devi grabbed a chair and sat in front of me. Her smile concealed her age and the hard life she has endured.

"This year, I harvested around 22 quintals per acre of Sahbhagi on my three acres of land," she said excited-

THE STRAW of Sahbhagi dhan, a drought-tolerant rice, is a popular cattle feed.

ly. (Twenty-two quintals is equivalent to 2.2 tons and one acre is 0.4 hectare.) "Over the last two years, when planting Sahbhagi, I earned around 20,000 rupees (about US$330) per acre."

Dr. Singh confirmed that the average yield of Sahbhagi dhan is 4 to 5 tons per hectare when other traditional varieties yield only about 2.5 tons under normal conditions. "What is remarkable is that even under severe drought, where traditional and other high-yielding varieties often yield nothing, Sahbhagi dhan can still produce 1 to 2 tons per hectare," Dr. Singh said. And since Sahbhagi dhan is a short-duration crop that matures in 105 days (medium- to long-duration traditional varieties take 120–150 days to maturity), another bonus is that farmers can plant the next crop earlier giving them enough time to plant three crops in a year!

Mrs. Devi plants peas, after rice, and then follows with onions. She usually earns $750 from her peas and as much as $580 from the onion crop. For the last two years, she has also been selling Sahbhagi seeds at about $0.50 per kilogram compared to $0.25 per kilogram when sold as grains. This gives her an extra $250.00 per ton of rice.

While a traditional variety such as Sarju55 requires four irrigations, Sahbhagi dhan requires only two. Farmers can save up to two irrigations; each irrigation usually incurs an energy cost of $30. Therefore, farmers planting Sahbhagi dhan can save $60 per crop.

WOMEN FARMERS, especially those from the lower castes, do most of the work in rice farming.

Empowered gender

The strong-spirited Mrs. Devi is known in the village for having a progressive outlook. She took on the role of the family breadwinner when her husband was stricken with hypertension and a heart problem, making him unable to work.

"God has blessed me with four cows, so no worries," she said with an air of cheerfulness that never left her face since I met her two hours ago. Cows are considered "helpmeets" in rural India as they provide milk, a source of protein for the family. She sells some extra milk to her neighbors. A cow can assure them of additional income of about $3 a day. Cows will continue to give milk for several months as long as they are healthy and well-fed. This is why Sahbhagi dhan straw is very important in most farming households.

"Four of my five daughters are married," she proudly related. In her village, a married daughter implies that a household has a healthy financial status because the cost of the dowry can range from $400 to more than $800—an amount that is difficult to come by for ordinary farmers.

"My life is now easier as I have only one daughter left to marry," she said. After that day comes, Mrs. Devi dreams of enhancing her "oasis" by purchasing a new house and maybe even a new car. She already owns a second-hand white van that she rents out as a public utility vehicle.

When a young man in his early twenties approached Mrs. Devi, she proudly introduced him as her son, who graduated from a three-year college course and now works in Bombay. Mrs. Devi has become an inspiration to other women in Nagwa. She has been able to save $800 through a self-help group (SHG) for women. This amount was added to the SHG's capital that is available for loans to members at very low interest rates. They can use the money for household or farm-related needs.

At the end of each year, they distribute the dividends among themselves. One woman farmer bought a pair of earrings from the dividend she got. "This speaks a lot about these women," Dr. Paris later pointed out. "The money they've earned themselves can now be used in any way they want. To them, jewelry is a valuable asset they can claim they own. They can sell it, use it as collateral for more loans or give it as a gift for a daugher's dowry. This is empowerment in plain clothes."

SINCE SAHBHAGI dhan matures earlier, farmers can plant three crops in a year. Mrs. Devi and her husband usually cultivate pea and onion crops after rice.

Ms. Reyes is the managing editor of Rice Today.

What's cooking?

Bhuna khichuri

ISAGANI SERRANO (4)

by **Mohammad Rafiqul Islam**

Bhuna khichuri is a very popular and common dish in Bangladesh and some parts of India that is usually prepared during rainy days or on special occasions. Its main ingredients are rice and protein-rich pulses. This makes it a highly nutritious but also delicious meal.

The dish is usually prepared using aromatic and slender-type rice such as kalizira, chinigura, badsha bhog, katari bhog, basmati, or jasmine. Bhuna khichuri can be served with fried ilish (a popular fish in Bangladesh), beef or chicken, fried egg, or vegetables for vegetarians.

Rafiq is a plant breeder at the International Rice Research Institute (IRRI). He is now involved in the development of rice that can withstand a certain amount of salinity for the poor farmers of South Asia such as those in coastal areas of Bangladesh. When not busy breeding salt-tolerant rice, he gets hold of spices such as turmeric, cumin, cinnamon, etc., and helps whip up something in the kitchen for his wife and his son and daughter.

Ingredients

- 8 cups water (boiling)
- 3 cups rice (basmati or other aromatic rice, prewashed)
- 1½ cups roasted pulses (mixture of lentil, black gram, and mung bean, roasted)
- 1 cup soybean oil
- 50 grams green peas
- 4 pieces green chili peppers
- 4 pieces cardamom
- 4 cinnamon sticks
- 3 onions (medium size, cut into very thin pieces)
- 3 cloves
- 2 bay leaves
- 1 whole garlic (chopped)
- 1 piece carrot
- 2 tablespoons salt
- 1 tablespoon ginger
- 1 tablespoon butter fat or ghee[1]
- ½ teaspoon cumin powder

Directions

1. Fry the onions in soybean oil until brownish in color. Adding a pinch of salt will make this quicker.
2. Add garlic, cumin, bay leaf, cinnamon, cardamom, green chilli peppers, carrot, ginger, and green peas and fry for 2–3 minutes.
3. Add rice and roasted pulses into the mixture and fry for 6–8 minutes.
4. Add butter oil or ghee and turmeric powder.
5. Add boiling water and the rest of the salt into the mixture. Cover the pot and wait for another 8–10 minutes.
6. Serve with fried fish, beef, chicken, fried egg, or any kind of vegetable.

[1] Ghee is the pure butterfat left over after the milk solids and water are removed from butter. It is commonly used in South Asian cooking.

Watch Rafiq demonstrate how to cook this dish in 7:06-video on YouTube at http://youtu.be/KunyYhz_6B8.

Bühler's all-new flagship rice optical sorter - SORTEX S UltraVision™

A giant leap in intelligent optical sorting for rice processors that refuse to compromise.

Customers were invited for a preview of the SORTEX S UltraVision™.

Rice processors recently attended Bühler's Competence Centre in Bangalore to attend the launch of the SORTEX S UltraVision™ - a new generation of optical sorter that represents a giant leap forward in intelligent sorting.

Designed to address challenging market requirements, it significantly increases profitability for rice processors by allowing them to define the exact quality level for their rice, even when faced with highly contaminated incoming material. What's more, there is no compromise in yield, meaning processors can deliver increased value for money to their customers. "Until now, rice processors have been forced to compromise between meeting customer specifications or minimising reject," notes Neil Dyer, Global Product Manager for Buhler Sortex. "But the SORTEX S UltraVision™ completely changes this scenario and addresses the critical industry issues."

As processors face increased competition and consolidation of rice mills, plus greater pressure to supply many different levels of rice quality, so they need to define more tightly which grains are acceptable and which they wish to reject. That is where the SORTEX S UltraVision™ stands out over other sorting options.

In-built intelligence enables the sorter to make intuitive decisions about which grain is good and which should be rejected, while its specific defect detection capability allows processors to adjust individually the sensitivity for each one of the many potential defects. This ground breaking functionality gives processors unprecedented control and ability to define the exact 'accept' levels necessary to meet their customers' requirements - thus eliminating waste and boosting profit.

The all-new SORTEX S UltraVision™ - next generation of advanced optical sorters.

Ben Deefholts, Buhler Sortex Rice Specialist, notes, "Many customers stress the need to remove yellow grains reliably, but agree that slightly grey or under-milled grains are acceptable up to a certain threshold. The SORTEX S UltraVision™ can distinguish between different shades, removing all subtle yellows without removing subtle greys."

Making the choice is easy, with a new user interface that allows swift changes from one rice product to another, or one quality standard to another, significantly reducing costly downtime. "Processors can consistently achieve export quality by just selecting the rice variety, setting each defect's sensitivity and pressing start!" adds Deefholts.

Control over every defect - adjust the amount of each defect to remove with a slider.

Consistency of sorting performance is further enhanced with Intelligent Automation. By constantly 'self-learning' the SORTEX S UltraVision™ always operates at the optimum level until the end of every batch. Daily operation and maintenance has also been made easier, and customers have 24/7 visibility of online data for maximum product yield and sorting optimization, fault alert, and system usage statistics. And of course, Bühler's global support is always on call.

"The SORTEX S UltraVision™ is part of our next-generation high capacity, energy efficient, 'Ultra-Line' rice processing equipment designed to help rice processors improve consistency and yield, reduce their energy consumption and maximise their revenue," concludes Buhler Sortex Managing Director, Hamid Kefayati.

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BÜHLER

ASEAN cooperation: Crucial to global food security

by **V. Bruce J. Tolentino**

The Global Rice Science Partnership offers all ASEAN members a comprehensive set of interventions and tools that can help the region attain its rice productivity and quality goals

There is a clear and present danger that another global food price crisis will emerge sooner rather than later.

A key signal is the lackluster result of the December 2013 Ninth Ministerial Conference of the World Trade Organization (WTO) in Bali, Indonesia—in the heart of the ASEAN community.

The complex of compromises arising from the WTO Bali meeting further demonstrates that many WTO member countries have re-focused on internal domestic politics, thereby sacrificing long-term gains shared across nations, particularly for less developed countries, in favor of short-term gains motivated largely by domestic political survival or sheer short-sightedness.

India's passage of its sweeping National Food Security Act in 2013, which requires immense food stockpiles and subsidies (see *India makes access to food a right, not a privilege* on page 43), and Thailand's maintenance of its costly rice pledging scheme are examples of domestic programs and policies that have prevented global multilateral trade reform from proceeding at a much more significant pace.

Rice, ASEAN, and global food security

Half the world's population eats rice. It is also the staple of 70% of the world's poor.

Association of Southeast Asian Nations

Asia produces 90% of the world's rice supply, much of it in ASEAN regions. Two of the world's largest producers and exporters of rice (Thailand and Vietnam) as well as two of the world's largest consumers and importers of rice (Indonesia and the Philippines) are part of ASEAN.

Another ASEAN member—Myanmar—recently emerged from isolation and has begun to explore its capabilities to re-assume its place as the world's largest exporter of rice, as it was in the 1950s (see *Myanmar rises* on page 28-29 of *Rice Today* Vol. 13, No. 1).

And Singapore, too small to produce the high-quality rice its wealthy and growing population wants, relies almost completely on trade. This underlines the importance of durable and reliable regional agreements on rice production and supply.

Many ASEAN populations were badly affected by the global food price crisis of 2007-09. A clear lesson from the crisis is that knee-jerk reactions of some countries worsened the problem overall and their particular situations. Unilateral actions exacerbated the food price increases. Although the sovereign actions were intended to deal with domestic food price inflation, these sparked dynamic interactions that led to a spiral of higher prices across the region and the world, since countries and economies are inextricably and unavoidably ever more linked, and actions in one country have impacts on all.

For example, by enacting controls on rice exports, exporting countries hurt their own rice farmers. Trade controls do not allow price signals to be fully transmitted from the international to the farm level. Thus, the poorest farmers do not gain from higher commodity prices and the poorest consumers do not benefit from lower-priced imports.

Moreover, the spiral in rice prices exacerbated hunger in countries that needed help the most—particularly the hungry populations of North Korea, Sudan, and many other

pockets of deprivation in many parts of the world—prompting the UN Secretary-General to issue a "global food emergency" warning.

Since the most recent food crisis, efforts among ASEAN members have been redoubled to strengthen their domestic capacity to manage their food supply. And, ASEAN members have begun to shore up agreements and platforms to share food security information and mechanisms for regional benefit.

The ASEAN already has a base to build a framework for multilateral dialogue and collaboration in the management of food supplies and prices. Since the 1970s, the ASEAN has been, in fits and starts, organizing and tinkering with the ASEAN Food Security Reserve—an agreement among members to set aside and share rice stocks in contingencies such as what is now being experienced.

Recently, ASEAN leaders adopted the ASEAN Integrated Food Security (AIFS) Framework and the Strategic Plan of Action on ASEAN Food Security (SPA-FS) at the 14th ASEAN Summit in 2009. The AIFS Framework and the SPA-FS were set for a 5-year period (2009-13) and "provided measures, activities, and timelines to facilitate cooperation in the implementation and monitoring process." Four components made up the AIFS: (1) food security and emergency/shortage relief, (2) sustainable food trade development, (3) an integrated food security information system, and (4) agricultural innovation.

The International Rice Research Institute (IRRI) was asked in 2009 by the ASEAN to focus its contribution to the AIFS and SPA-FS on component 4 (agricultural innovation), which in turn was made up of three strategic thrusts: (1) promote sustainable food production, (2) encourage greater investment in food and agro-based industry to enhance food security, and finally (3) identify and address emerging issues related to food security. Thus, the AIFS and SPA-FS included a Rice Action Plan proposed by IRRI.

As part of the Rice Action Plan, the Senior Officials Meeting of the ASEAN Ministries on Agriculture and Forestry (SOM-AMAF) were tasked to work with IRRI on the following: (1) better crop management practices, (2) testing new rice varieties developed by IRRI, and (3) training young scientists and researchers at IRRI.

GRiSP

Globally, the Rice Action Plan for ASEAN has been implemented by IRRI through *the Global Rice Science Partnership* (GRiSP), the CGIAR Research Program on Rice.

Launched in 2010, GRiSP represents for the first time a single strategic work plan for global rice research. GRiSP brings together hundreds of scientists from across the world in the most comprehensive attempt ever to harness the power of science to solve one of the most pressing development challenges of the 21st century. GRiSP aims to reduce poverty and hunger, improve human health and nutrition, reduce the environmental footprint, and enhance ecosystem resilience of rice production systems through high-quality international rice research, partnership, and leadership.

GRiSP plans to achieve these important goals by fostering high-quality, impact-oriented research and development activities. The key entry points for achieving this mission lie in lifting the productivity and resource efficiency of rice production systems to unprecedented levels. This will enable farmers to enter a virtuous circle, allowing them to also invest more in diversification and sustainable management practices.

To achieve impact at scale, GRiSP scientists collaborate with hundreds of development partners from the public and private sector across the globe. Together, they align and bring to the table consortia, networks, platforms, programs, and collaborative projects with more than 900 partners from the government, nongovernment, public, private, and civil society sector.

ASEAN and GRiSP

At the 35th AMAF meeting in Kuala Lumpur in September 2013, the ministers appreciated IRRI's report on the progress of GRiSP, noting: "… the contribution of GRiSP to support the AIFS and SPA-FS to ensure rice would be affordable to poor [consumers], yet profitable to farmers, of better quality, and [have] nutritious value."

The Ministers recalled their "… earlier approval by AMAF in 2011 and considering the need to maximize the impact of collaboration and cooperation with development and donor partners as well as taking into account the ongoing ASEAN initiatives, the Meeting agreed to continue supporting GRiSP to accelerate rice productivity and quality in the region. The Meeting tasked the SOM-AMAF with assistance of the ASEAN Secretariat to work with IRRI on the implementation of the initiative." In this regard, IRRI will work with SOM-AMAF to secure the resources necessary to implement GRiSP across the ASEAN region.

The result of the 35th AMAF meeting echoes that of the 33rd AMAF meeting in Indonesia in 2011, which expressed the AMAF's "… support for GRiSP, led by the IRRI, as it represents an important expansion and development of 2008's ASEAN Rice Action Plan."

Moreover, the 34th AMAF meeting in Laos in 2012 issued the following statement: "We, while noting the good progress in the implementation of the ASEAN Integrated Food Security (AIFS) Framework and the Strategic Plan of Action on ASEAN Food Security (SPA-FS) (2009-13), including the entry into force of the ASEAN Plus Three Emergency Rice Reserve (APTERR) Agreement, agreed to remain vigilant on the opportunities and challenges of food security in the region and the world, particularly at a time of high volatility of commodity prices and economic uncertainties. Moreover, we agreed to continue building on existing mechanisms and exploring new initiatives that contribute to food security in the region… With the continuing support from … GRiSP, led by IRRI."

IRRI (8)

To meet its goals in Southeast Asia, GRiSP is structured as six interconnected research and development themes:

Theme 1: Harnessing rice genetic diversity to identify new productivity, quality, and health opportunities for rice consumers in Southeast Asia;

Theme 2: Accelerating the development, delivery, and adoption of improved rice varieties for farmers in Southeast Asia;

Theme 3: Continuing to develop and introduce ecological and sustainable management practices for rice-based production systems in Southeast Asia;

Theme 4: Extracting more value from rice harvests through improved quality, processing, market systems, and new products;

Theme 5: Providing technology evaluations, targeting, and policy options for enhanced impact in the rice sector in Southeast Asia; and

Theme 6: Supporting the growth of the rice sector in Southeast Asia.

GRiSP offers all ASEAN members a comprehensive set of interventions and tools to capture the advances in global science for deployment in their individual national rice research and extension systems. While GRiSP's interventions and tools can be tweaked to suit the specific challenges faced in each country, its thematic approach serves as a shared framework that facilitates multilateral coordination and cooperation.

Indeed, multilateral cooperation and action mindful of dynamic impacts are crucial to curbing volatility in rice and food prices. The governments of ASEAN members, especially those of importing and exporting countries, must share information on cross-country stocks and prospects that enable rational, moderate, and longer-term assessments of supplies and prices.

Such dialogue will underlie international understanding and assurances that both rice exporting and importing countries have a shared interest in stable, if higher, rice prices. Food prices will likely settle at higher levels than experienced since the mid-1970s, and this augurs well for farmers and long-term higher total world supplies.

It is high time that GRiSP and other comprehensive programs, and continuing shared food security discussions, are accelerated and implemented for the benefit of all.

Dr. Tolentino is the deputy director general for communication and partnerships at IRRI.

Blazing the trail of women's empowerment

by Ma. Lizbeth Baroña-Edra

Thelma Paris has contributed to bridging the gap between rice technologies and women farmers

AMELIA CUENO

She grew up watching a young widow pull life together out of meager means to shelter her seven children. Perhaps this is why Thelma Paris, retired senior scientist and gender specialist at the International Rice Research Institute (IRRI), understood the importance of creating opportunities for those who are without it.

"Growing up, our family went through a lot of hardships," said Dr. Paris. "When my father died, our oldest sibling was 17 and the youngest was one year old. It was a tough time for Mother."

Her mother was a dentist at the University of the Philippines Health Service and Dr. Paris served as her dental assistant during house calls. "I started working at an early age because my mother had to supplement her salary to make ends meet," she said. "But my mother was not only strong, she was also wise. She made good decisions." Good decisions that would later reflect on how Dr. Paris took her own journey forward.

Following her road

In 1975, her husband Tirso received a fellowship for his doctorate studies at IRRI. Dr. Paris decided to tag along with Tirso to meet his boss, Edwin Price, then an IRRI agricultural economist. The conversation ended with Dr. Price offering Thelma a job as a research assistant. Without hesitation, she accepted the offer.

After earning her master's degree, Dr. Paris was assigned to conduct a research project called *Linking agricultural production and human nutrition* in remote villages in Cagayan Province in the northern part of the Philippines. This was her first glimpse of what would be her lifetime passion.

"I interviewed a mother with a sick son," she related. "He was diagnosed as suffering from severe malnutrition. We immediately took him to the town clinic."

After that incident, Dr. Paris started building her personal knowledge of the role of mothers and the problems they face in terms of food consumption and nutrition.

She later worked for National Scientist, and current IRRI consultant, Gelia Castillo, who was then a visiting scientist. At that time, Dr. Castillo was the coordinator of the Women in Rice Farming Systems project under the Asian Rice Farming Systems Network. Dr. Paris tried integrating women's concerns in a crop-livestock farming systems project in Sta. Barbara, Pangasinan, in the Philippines. The research, *From Field to Lab and Back: Women in Rice Farming Systems,* became the first gender-focused case study featured by the CGIAR Gender in Agricultural Project network.

Gender rising

It was her trip to India, however, that crystallized her fervor to help marginalized women.

"A video shown at a plenary session in one of the conferences I attended featured a farming couple walking on a road," she recalled. "The wife, walking behind the husband, was carrying a heavy load of rice stalks on her head, while carrying her baby. The husband, who was walking in front of her, was not carrying anything. I was deeply moved."

Dr. Paris knew that something in the system needed to be examined more closely and, if appropriate, changed. She investigated the factors that determine gender roles in rice-based farming systems in farming villages in eastern Uttar Pradesh, India, under a project funded by the International Fund for Agricultural Development.

Based on her studies, it was evident that women from the lower caste contributed 60–80% of the total labor inputs in rice production and postharvest activities. And yet, because of deeply embedded social and cultural norms, they did not have access to technologies such as postharvest equipment, seeds of improved rice varieties, crop and natural resource management practices, and training opportunities.

"We can no longer ignore the changing and potential roles of women farmers amidst the transformation in agriculture," Dr. Paris said. "The number of men migrating from rural to urban areas will continue to increase, leaving more women behind to manage their farms and households, and care for young children and the elderly."

Dr. Paris led the gender research team at IRRI, in collaboration with national agricultural research and extension system partners to meet the technology needs of women. They invited more women farmers into participatory varietal selection in stress-prone rice areas. They also provided them with seeds of stress-tolerant rice, also known as climate-smart rice, through self-help groups. Other activities involving women were testing threshing equipment, conducting training activities, and introducing agribusiness models.

As her way of paying back, she developed the first leadership course for Asian and African women in research and extension. She loves to mentor young women and hopes that they will follow her trail and be key agents of change themselves.

Taking opportunity by the horns

"It was in 1996 when I went to Washington, D.C., to receive my award given by the CGIAR on excellence in science—outstanding local professional," she related. At the same time as the conferring of the award, a meeting involving directors general of all of the CGIAR centers and donor agencies was underway in Washington.

Mahabub Hossain, then head of IRRI's Social Sciences Division, kidded that he would pay my hotel accommodations for one more day so that I could meet people and solicit funding for the Women in Rice Farming Systems research project," Dr. Paris said. "I did not know what to do. I was a junior staff then who worked in the background. No one knew me there.

"At the event's dinner, I was pondering how I could meet a donor. I felt that the opportunity to meet a donor was very slim. Instead of going out there to approach the big guys, I decided to step out from the crowd and I tried to compose myself. Then, out of the crowd, a man walked toward me. His name tag read Ebbe Shioler. Mr. Shioler was a senior program officer of the Danish International Development Agency (DANIDA) at the time.

"Suddenly, I felt a surge of confidence. I introduced myself to him and started talking about our gender research, and requested funding," recalled Dr. Paris. "I introduced him to Dr. Ken Fischer, then IRRI deputy director for research, and Dr. Roelof Rabbinge, chairman of the Board of Trustees. The next day, I was invited to a breakfast meeting to discuss DANIDA's funding for IRRI. I walked away from the meeting with a US$480,000 pledge for gender research."

The better half

Although the passion of Dr. Paris for gender issues has always been apparent to anyone she gets the chance to talk with about her work, her marriage is a crucial aspect that affirms her life's work.

"I am lucky to have a husband who allows me to spread my wings and still come home to a warm and loving family," she said.

Even when she was contemplating taking up her doctorate studies abroad, her husband reassured her that he would take care of their children in her absence.

Dr. Paris pursued her PhD from the University of Western Sydney in Australia and later became an affiliate scientist in IRRI's Social Sciences Division. "I was the first nationally recruited staff who did not have to resign from my post to get a PhD," she said.

That, and many other firsts, defines Dr. Paris's journey at IRRI. She happily looks back on her path even as she contemplates new trails to blaze in retirement. For now, she savors the time she spends with her husband, their two sons, Carlo and Ivan, and daughter-in-law, Myles. "Andre, my grandson who is the apple of our eyes, just gained a new regular playmate," Dr. Paris laughed.

Ms. Baroña-Edra is a science communication specialist at IRRI.

BEHIND THIS successful woman is her family who has enabled Dr. Paris to pursue her passion of empowering other women.

PARIS FAMILY

Mapping opportunities to increase productivity in coastal Bangladesh

by **Parvesh Kumar Chandna, Andy Nelson, Md. Zahirul Haque Khan, Md. Moqbul Hossain, Md. Sohel Rana, Fazlur Rashid, Manoranjan Mondal,** and **T.P. Tuong**

In the coastal polder zone of Bangladesh, satisfying food demand and improving the livelihoods of about 8 million people while at the same time preserving natural resources are major challenges.

Eighty percent of the population in this zone lives below the national poverty line and many farms rely on a single low-yielding crop of rice grown during the *aman* (rainy) season. A large area remains uncultivated at other times of the year because of waterlogging, salinity, poor drainage, and poor management of the water infrastructure. The coastal zone is also highly vulnerable to flooding, drought, and cyclones.

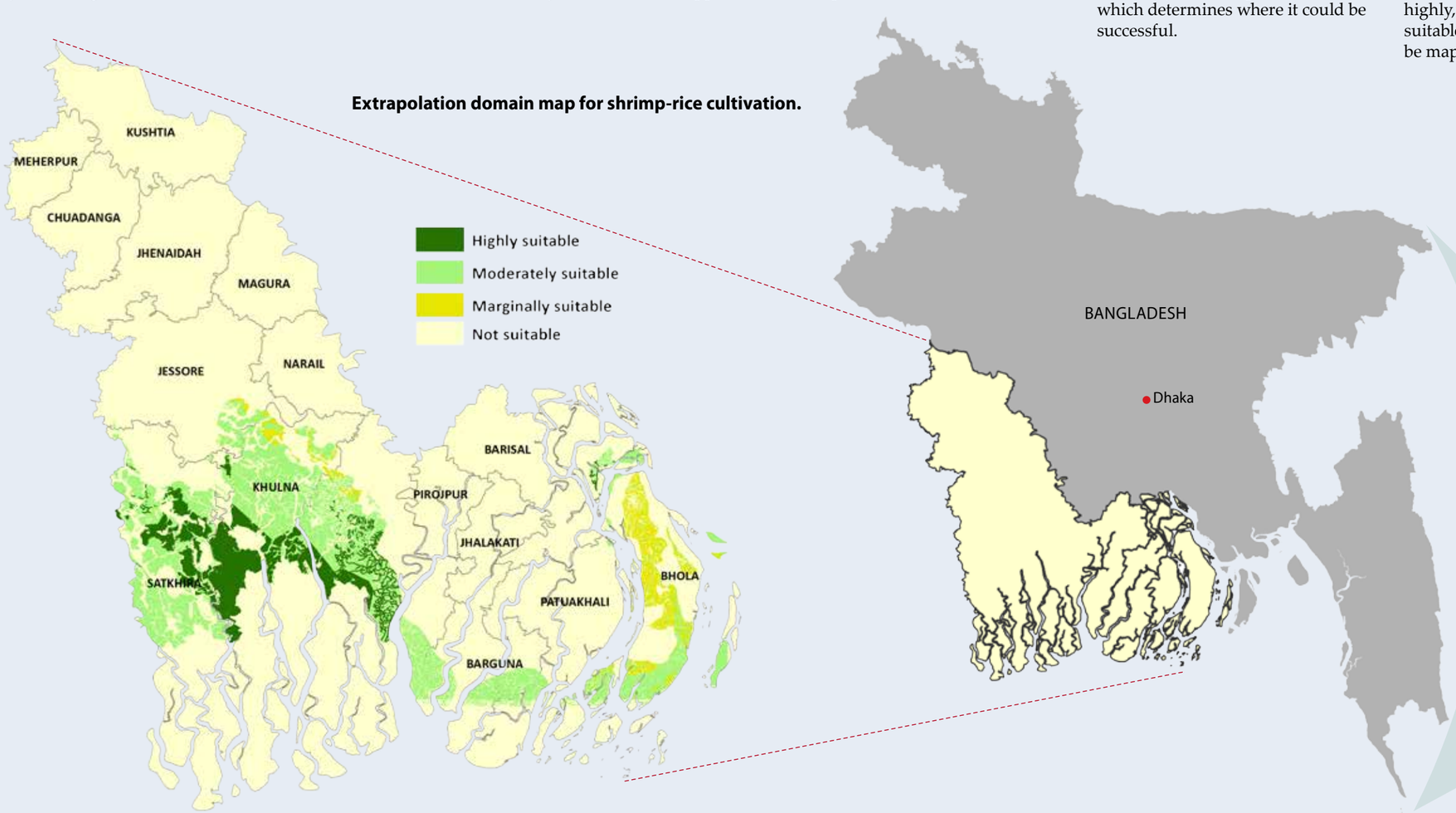
However, the coastal area is also full of opportunities to improve the population's food security and livelihood because the region has fertile soils and a good network of rivers and *khals* (channels for irrigation and drainage). The Ganges Basin Development Challenge (GBDC) Program of the CGIAR Challenge Program for Water and Food is focusing on improving livelihoods and increasing productivity sustainably in the coastal polder zone, and has developed and tested innovative cropping systems and water management practices suited to the local conditions.

Before a new cropping system can be recommended, it is important to identify its "extrapolation domain," which determines where it could be successful.

One example system is rice-shrimp cultivation where rice is cultivated between August and December followed by shrimp between February and July. The land-use requirements for rice are based on rainfall in July and August, river water salinity in August, inundation depth, proximity to a drainage canal, and soil type. The requirements for shrimp cultivation are based on weather, water salinity, inundation depth, and soil. These requirements are combined in a decision tree to define different levels of suitability for this cropping system. Once this model is in place, spatial datasets for each requirement are collected, and areas that are highly, moderately, marginally, or not suitable for a shrimp-rice system can be mapped.

There are many sustainable and profitable cropping systems that can be adopted in the polder region and each one will have its own extrapolation domain map. These maps can be assessed together to determine the most appropriate land use in a given polder and thus support local and regional resource management decision making. This collaborative effort has brought together expertise and data from many organizations to answer questions on how productivity in a complex and fragile environment can be sustainably increased.

Dr. Chandna is a researcher in remote sensing and GIS modeling in the Social Sciences Division (SSD) at IRRI. Dr. Nelson is a geographer and head of the GIS laboratory at IRRI. Mr. Khan is a principal specialist at the Institute of Water Modeling in Bangladesh. Dr. Hossain is a principal scientific officer of the Soil Resource Development Institute in Bangladesh. Mr. Rana, is an assistant engineer in the GIS Unit of the Local Government Engineering Department of Bangladesh. Mr. Rashid is an executive engineer at the Bangladesh Water Development Board. Dr. Mondal is a collaborative research scientist in the Crop and Environmental Sciences Division and SSD at IRRI. Dr.Tuong is an IRRI consultant.



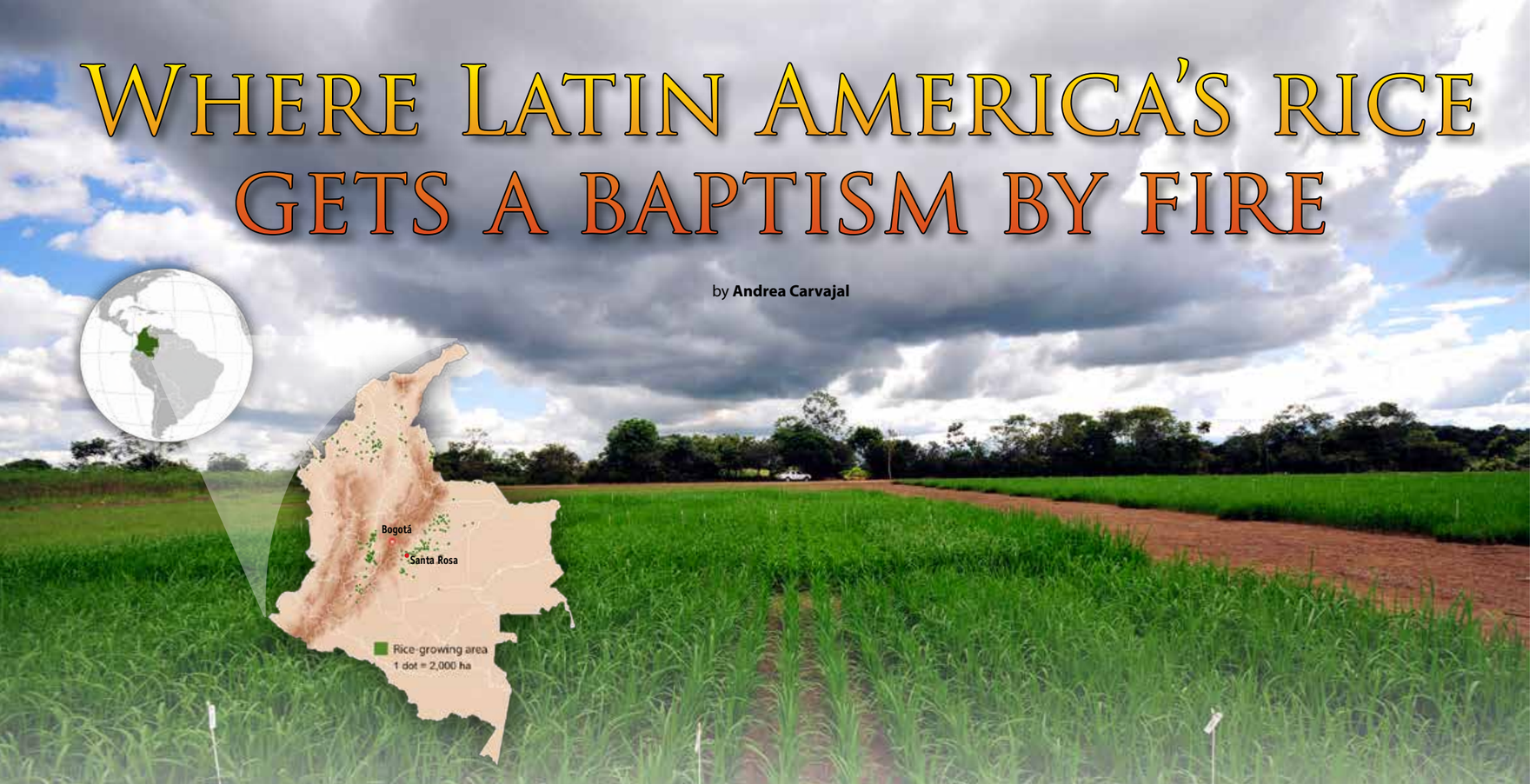
Extrapolation domain map for shrimp-rice cultivation.

Gene Hettel

Bhutan, a small South Asian country wedged between India and China high in the Himalayas, has some of the most spectacular rice landscapes on the Subcontinent. Here in Trashigang District in the extreme eastern part of the country, the rice harvest has begun in mid-October.

Where Latin America's rice gets a baptism by fire

by **Andrea Carvajal**



The Santa Rosa Experiment Station in Colombia is where all new rice varieties are rigidly scrutinized before they reach farmers' fields across Latin America

The long and tortuous route traveled by many of the more than 400 improved rice varieties developed in the last several decades by the International Center for Tropical Agriculture (CIAT), in collaboration with its many partners, leads through a decidedly out-of-the-way spot. This is the Santa Rosa Experiment Station, located 17 kilometers outside Villavicencio, the capital of Colombia's Meta Department, in the heart of the country's vast Eastern Plains.

These 400 varieties are direct seeded to a great extent—estimated at nearly 60% of the approximately 3.2 million hectares sown to the crop in Latin America and the Caribbean—and they produce around 27 million tons of paddy rice per year.

A hotspot for rice

Santa Rosa is an ideal site to evaluate rice germplasm for this region. Combining high pressure from major diseases with just the right conditions for problems affecting grain quality, it also experiences a long, harsh dry season, which permits effective selection for drought tolerance.

"In 1982, I visited Colombia's National Rice Growers Association, known as Fedearroz, and explained the need for an excellent evaluation site that would meet all the key requirements for genetic improvement," said famed rice breeder Peter Jennings, in describing how the Santa Rosa Experiment Station was chosen. The station celebrated its 30th anniversary in 2012.

A pioneer of the Green Revolution in rice (see *Luck is the residue of design* on pages 10-11 of *Rice Today* Vol. 8, No. 1), Dr. Jennings made the cross resulting in IR8—the 1960s variety that essentially doubled the crop's yield potential in Asia and elsewhere. He developed many more varieties during his time as a rice breeder at the International Rice Research Institute (IRRI) and Rice Program leader at CIAT in the 1980s, and more recently with the Latin American Fund for Irrigated Rice (FLAR).

Santa Rosa is a "hotspot" in more ways than one. Its temperatures usually hover around 25 °C and it has exceedingly high levels of rice blast, one of the most damaging fungal diseases of the crop worldwide.

Dr. Jennings' proposed location won support. In 1983, Fedearroz purchased the 30 hectares then belonging to the farm *Las Brisas*. Its name, meaning "the breezes," is actually quite fitting and doesn't reflect the original owners' wishful thinking or sense of humor. Since the early 1980s, the station has been managed by CIAT, serving as a key focal point for collaborative agricultural research.

Defusing blast

For rice blast research, Santa Rosa is the scene of a perpetual perfect storm, according to Fernando Correa, a senior rice pathologist who spent many years working at the station. "The conditions at Santa Rosa are such that, within the disease pathogen's population, individual races develop, showing a wide variety of disease virulence genes that can overcome genetic resistance," he said. "This gives plant breeders the opportunity to identify the best resistance sources for crossing and to select lines with combinations of resistance genes that can control this variability in the pathogen."

But, that's just part of the story, according to Dr. Correa. "Since the pathogen at Santa Rosa has virulence genes for many known resistance genes, the resistance developed under these conditions can be applied to conditions elsewhere. This is why our work on blast at Santa Rosa has contributed so importantly to identifying rice lines resistant to pathogen populations that are in other countries of Latin America."

The proof of his assertion consists of 48 improved varieties that FLAR has developed in recent years for 12 countries of the region, with three cycles of selection for disease resistance at Santa Rosa.

Of rice and men and women

Over the last three decades, the station has witnessed the birth of many outstanding rice varieties, which include Oryzica 1, Oryzica Llanos 5, Fedearroz 50, Fedearroz 2000, Fedearroz 369, Fedearroz 174, Fedearroz 733, and Fedearroz Lagunas Cl. Santa Rosa also became the cradle in the development of Oryzica Sabana 6, the first rice variety adapted to acid soils in Colombia.

Many accomplished rice scientists have spent long days working in the experimental plots of Santa Rosa. The list includes Dr. Jennings, Sarkarung Surapong, Elcio Guimarães, César Martínez, James Gibbons, Marc Chatel, Cecile Grenier, Héctor Weeraratne, Sang Wong Ahn, Robert Zeigler (director general of IRRI), Fernando Correa, Gloria Mosquera, Alberto Pantoja, Albert Fisher, Joaquín González (deceased), Joe Tohme, Luis Eduardo Berrío, Luis E. Dussan, Marco Perdomo, Miguel Rubiano, Julio Holguín, Édgar Tulande (deceased), René Aguirre (deceased), Yolima Ospina, James Carabalí, Jaime Borrero, Argemiro Moreno, Édgar Corredor, Elías García, Eugenio Tascón, Luis Roberto Sanint, Gonzalo Zorrilla, Édgar Torres, Eduardo Graterol, Alfonso Díaz, Diego Alba, and Jaime Gómez, among others.

The station is a symbol of CIAT's strong commitment to strengthening the capacity of national rice research organizations in Latin America. About 500 professionals from these organizations, including specialists in extension and education, have received technical training at Santa Rosa in rice improvement and management. Today, many of these people form part of the new generation of research and development leaders in organizations across the region.

In full bloom

Research at the station is still going strong and it plays a critical role in a renewed push to accelerate agricultural development in the Eastern Plains. To this end, CIAT has strategically partnered with the Ministry of Agriculture and Rural Development and the Colombian Corporation of Agricultural Research (CORPOICA) for scientific collaboration in Colombia's wider Orinoquia region.

Within this framework, new research starting in 2011 encompasses diverse themes, including soils and ecosystem services; major production systems with maize, rice, soybean, and tropical forages; site-specific agriculture; and climate change adaptation and mitigation.

Meanwhile, Fedearroz is developing at Santa Rosa a strategy to widely disseminate rice research results obtained so far in the Eastern Plains, including improved varieties that are tolerant of acid soils and resistant to rice blast and other major diseases, and that show high yield potential and good adaptation to the region's variable growing conditions.

In the near future, Santa Rosa will acquire a high-tech laboratory that will help identify rice diseases and insect pests and be used for molecular genetic analysis. This new facility will help rice producers in the region, while facilitating the CIAT Rice Program's selection of improved varieties for Colombia and Latin America.

Ms. Carvajal is a corporate communications officer at CIAT.

When there is rice in the barn, all else will follow

Retold by: Anupa Roy
Illustrated by: Genavee Lazaro

Rice plays a central role in the culture and economy through the barter system of the Ao Naga tribe in Nagaland, a state in northeastern India.

In the northeast corner of the Himalayas, where the mountain mists meet the land, the jungle grew thick and lush. Here lived the Ao Naga tribe. It is believed that the tribe migrated there from northern China or Mongolia many centuries ago.

The men of the tribe hunted in the forests and fished in its many streams while the women toiled in the rice fields. Yet, food was never enough, for it was difficult to keep back the jungle from the fields.

A wise old man with his grandson lived in the village. "It is all very well to hunt and fish," he called to the men. "But the rice fields need your care."

"What is the use?" said the men. "The jungle is too powerful. Besides, working the fields is women's work."

So saying, they laughed and went off. The grandson wanted to join his friends but the old man refused to let him hunt and fish. "Help me first in the rice fields," he said.

Reluctantly, the lad worked alongside his grandfather.

"Not a single man works here, Grandfather," he grumbled. "Why should I?"

The old man did not answer.

In the morning, the old man called to one of the men as they left. "Can you bring me a live fish from the stream?"

That evening, he put the wriggly fish that was brought to him in the water trough. "Tomorrow, you must catch that fish by hand and cook it," he told his grandson.

Next morning, the old man went off to the fields, alone. Meanwhile, the lad spent the entire day catching the fish by hand. But, try as he might, the fish wriggled out of his hands.

"If you can't catch a fish in a trough, how will you catch one in the stream?" said the old man at dinnertime. "Tend to the rice, and the fish will come."

Months went by as the old man and his grandson worked in the rice fields. Together, they kept back the forest, transplanted the rice, and weeded the fields. The paddy grew tall and green.

Meanwhile, the women in the other fields struggled as they tried to cut back the forest and care for the paddy. The weeds and the birds destroyed the plants.

At harvest time, the grain in most fields was thin and straggly. But, in the fields of the old man, the paddy stood thick and golden. He and his grandson gathered in the grain and filled two large granaries.

Then winter came. The animals had gone and the streams had few fish. While the villagers starved, the old man and his grandson had plenty of rice to eat. Soon, the villagers came to them.

"Please give us some rice," the hungry villagers pleaded.

The old man gave them some rice but he made them promise to bring him some fish and meat. So, every day, through the winter, the old man shared his rice with the villagers. And each day, they brought him some fish or game. "If only you had listened to me and helped the women in the rice fields," he said, shaking his head.

Spring came and it was time to plant the paddy again. This time, the men joined the women in the fields. Now, they went hunting or fishing only after the chores in the rice fields were done.

"You can join the hunt," the old man said and smiled at his grandson.

"After I've tended the paddy, Grandfather," laughed the lad. "When there is rice in the barn, all else will follow."

Ms. Roy is a freelance writer who is based in Singapore.
Ms. Lazaro is a fine arts student at the University of the Philippines Diliman.

by **Leah Baroña-Cruz**

ISAGANI SERRANO

TAKING THE PLUNGE into the hard, risky business of actually growing rice, Dr. Dobermann was able to see things better from the farmers' perspective.

Putting rice on the global agenda

Achim Dobermann's term as head of research at the International Rice Research Institute (IRRI) saw a period of constructive upheavals in the way the Institute conducted science and reshaped rice research into a truly global alliance.

"The job of deputy director general for research at IRRI is probably the most interesting job in the whole CGIAR," says Dr. Dobermann, a soil scientist who left IRRI in 2000 and came back in 2007 to head the program on sustaining productivity in intensive rice-based systems and became the head of research in 2008. Under his leadership, IRRI developed a whole new strategy that stabilized funding and gave researchers space to be creative. A lesser visionary could not have pulled this off.

A more stable "fuel line"

IRRI was about to mark its 50th year and seemed ready for a new direction when Dr. Dobermann took the reins of its research. "I came at the right time, I think, as IRRI had embarked on a new strategic plan, which presented many opportunities," he says.

For instance, he perceived a growing international interest in hybrid rice, but IRRI was hampered in obtaining public funding for its hybrid rice breeding program.

"The only way out of the bind was a whole new model—a public-/private-sector partnership," Dr. Dobermann recounts.

So, the Hybrid Rice Development Consortium (HRDC) was formed, comprising 15 national research centers and 19 private company members. Through it, germplasm exchange between IRRI and its partners grew more than tenfold from five years ago and now the HRDC has 68 members nearly equally represented by the public and private sectors. The new partnership model also resulted in a more stable funding base and opened up a whole range of partnership options for IRRI, especially with private companies.

In the last five years, many new programs were developed, expanding in both scope and intensity IRRI had not seen before. The Institute started projects in new regions, such as East and southern Africa. It succeeded in getting support from new donors, including the Bill & Melinda Gates Foundation, tripling the Institute's funding during the period.

Forming alongside these developments was the Global Rice Science Partnership (GRiSP)—the "mother ship" that unified all these efforts.

One program to run them all

As head of research, Dr. Dobermann cited as his biggest challenge "the constant need and difficulty" of getting a long-term research strategy

R RAMAN, AFRICARICE

RICE IS BECOMING increasingly important in Africa. In Liberia, Dr. Dobermann (*extreme right*) interacts in the field with his AfricaRice counterpart Marco Wopereis and local farmers.

funded from many projects and sources.

About 70% of IRRI's research is funded by some 140 grants from more than 60 donors, each with its own set of work plans, partners, and reports. An overarching, longer-term research agenda that goes beyond the goals and timelines of individual projects is what he believed would help IRRI get all of its diverse projects into a single groove.

Things started taking shape in 2008, during the annual general assembly of CGIAR in Mozambique, when the 15-center group was considering major changes in the way it worked. Dr. Dobermann hoped that any reforms would somehow fix what he called "too much short-term thinking and too much short-term funding."

"People were talking about 'mega-programs,' but seemed unclear on what those might look like," he says of the 2008 meeting. "We felt that the best way forward was to create an example."

On the way back from Mozambique, he and IRRI Director General Robert Zeigler visualized what an integrated global program on rice that combined the missions of IRRI, the Africa Rice Center (AfricaRice), the rice program of the International Center for Tropical Agriculture (CIAT), and hundreds of other partners worldwide would look like.

That idea was fine-tuned, and the plan was endorsed by CGIAR and major national partners in Africa, Asia, and Latin America. "We also discussed this a lot with the donors, and they were very encouraging," Dr. Dobermann adds.

He believes that GRiSP—the first new research program of CGIAR—is "still very much the standard" for the consortium's other research programs.

On-the-job lessons

Some visions turned out to be quite tricky to carry out, especially some very large-scale projects, but important lessons were to be learned from these.

"Most of the things we set out to do, we achieved," he says. "In some cases, we achieved more than we hoped for. And then there are those that did not work out as we intended, or remain unfinished."

Many changes had to take place on a smaller scale to support the major shifts in the big picture, including adjustments in IRRI's internal research management structure, improved career paths for the research staff, more interdisciplinary work, and better interaction with partners.

Do upstream more

To have the greatest impact, Dr. Dobermann believes IRRI must maintain its focus on high-quality science instead of moving too far downstream into areas for which other organizations may have the comparative advantage.

"IRRI needs to focus on innovations for the future, but these must be demand-driven and very clearly linked to real-world solutions needed by farmers and others along the value chain," he says.

"We must also continue to find ways to work with the private sector, especially because private investment in rice R&D has been rising, particularly in Asia.

"Lastly, I think that IRRI is in need of a whole new education strategy," concludes Dr. Dobermann, who for a time put on a farmer's hat for the pioneering *IRRI Agronomy Challenge*, which many consider to be the Institute's first "reality show" on growing a crop of rice. (see *Knee-deep in mud* on page 16-19 of *Rice Today* Vol. 11, No. 3)

"Many of us still don't fully understand what we're doing and why we're doing it," he says. "The general education side of things—the big why—should go with everything else we teach."

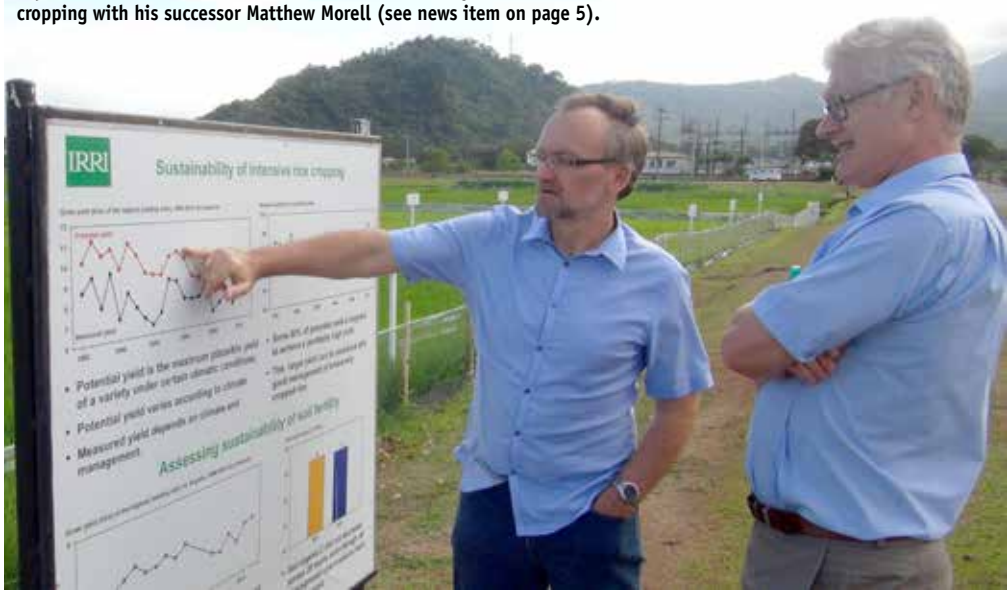
A place for big ideas

"There is never a perfect time to leave a job, because the work needs to continue," says Dr. Dobermann, who will assume the post of director of Rothamsted Research in the U.K. "But, I feel quite comfortable leaving now because I believe that I have achieved many, if not all, of the goals that I set for myself in terms of providing a new and expanded strategy for IRRI's research."

He credits IRRI for being a place where big ideas get a chance at proving themselves: "I do not know of any other research institution where one can have the combination of a very challenging and inspiring mission, and a work environment like this."

Ms. Baroña-Cruz is a writer-editor at IRRI.

DURING THE 150th crop of IRRI's Long-Term Continuous Cropping Experiment, Dr. Dobermann discusses the sustainability of intensive rice cropping with his successor Matthew Morell (see news item on page 5).



GENE HETTEL

Climate-smart rice for Africa

by **Savitri Mohapatra**

Africa faces the reality of climate change with new rice varieties adapted to environmental stresses expected to become more frequent and intense

"The best adaptation to climate change is a breeding and seed system that rapidly develops, deploys, and then replaces varieties so that farmers will always have access to varieties adapted to their current conditions," said Gary Atlin, senior program officer, Bill & Melinda Gates Foundation, in his keynote address at the 3rd Africa Rice Congress held in October 2013 in Yaoundé, Cameroon.

This strategy is at the heart of the project Stress-Tolerant Rice for Africa and South Asia (STRASA), which is helping smallholder farmers who produce their crop under mainly rainfed conditions and are vulnerable to flooding, drought, extreme temperatures, and soil problems, such as high salt and iron toxicity, that reduce yields. Some of these stresses are forecast to become more frequent and intense with climate change.

Climate change and farming

Climate change is already having a negative impact on Africa through extreme temperatures, frequent flooding and droughts, and increased salinity according to Baboucarr Manneh, irrigated-rice breeder at Africa Rice Center (AfricaRice) and coordinator of the African component of the STRASA project.

These environmental stresses covered by the STRASA project have a significant impact on the productivity of rice farms and farmers' income. Drought, for example, is a major problem in rice-growing areas of Africa that are predominantly rainfed. Rice yield losses attributed to iron toxicity range from 10 to 100%, with an estimated average of 50%. A survey

COLD-TOLERANT rice variety nominated as ARICA10 by Africa Rice Breeding Task Force.

conducted in three West African countries (Cote d'Ivoire, Ghana, and Guinea) by AfricaRice and national partners showed that more than 50% of the lowlands studied and about 60% of the cultivated rice plots were affected by iron toxicity.

"Until now, farmers didn't have any solution to climate change except to keep using their traditional varieties," said Peinda Cissé, a rice seed producer and founder-president of FEPRODES in Senegal (see *Senegal's mother of modern rice farming*, pages 38-39). She cited the Senegal River Delta as an example. Vast areas in the delta have been abandoned by rice farmers because of high soil salinity.

Mrs. Cissé also mentioned low night temperatures that often drop to 9°C during the *harmattan* (a dry, dusty wind on the West African coast occurring from December to February) season as another big constraint to rice production in the region.

A new generation of rice

"That is why we welcome the new rice varieties tolerant of salt, cold, and iron toxicity for Africa announced by the Africa Rice Breeding Task Force," she said.

The stress-tolerant varieties are welcome additions to the ARICA (Advanced RICes for Africa) brand which was launched by AfricaRice in 2013 to offer farmers a new generation of high-performing rice varieties for Africa.

Unlike the NERICA varieties, the ARICAs are not restricted to interspecific crosses. Any line that shows promise, regardless of its origin, can become an ARICA variety as long as the data that are collected are convincing.

ARICA varieties are selected after being successfully tested in many different conditions, including

DR. BABOUCARR Manneh, STRASA-Africa Coordinator, working in the molecular biology laboratory, AfricaRice-Saint Louis, Senegal.

R.RAMAN, AFRICARICE (4)

participatory varietal selection involving farmers. Improved rice varieties that are approved for release by some countries are also considered. Five ARICA varieties—three for rainfed lowland and two for upland ecology—were selected in 2013.

In March 2014, the Rice Breeding Task Force nominated the second series of ARICA consisting of six varieties with improved tolerance of environmental stresses, one of which is noteworthy as it combines tolerance of iron toxicity and of cold temperatures:

Iron-tolerant
- **ARICA 6** (IR75887-1-3-WAB1): released in Guinea and identified for release in Ghana
- **ARICA 8 (**WAT 1046-B-43-2-2-2): released in Burkina Faso and identified for release in Guinea

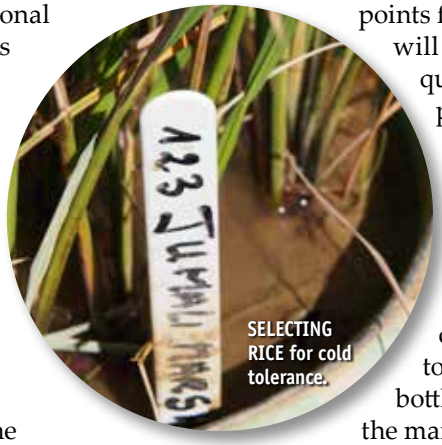
Cold-tolerant identified in Mali
- **ARICA 9 (**SIM2 SUMADEL)
- **ARICA 10 (**WAS 200-B-B-1-1-1)

Salt-tolerant
- **ARICA 11 (**IR63275-B-1-1-1-3-3-2): released in The Gambia.

Cold- and iron-tolerant
- **ARICA 7 (**WAS 21-B-B-20-4-3-3): identified for release in Ghana (tolerant of iron toxicity)/identified for release in Senegal (cold-tolerant)

These varieties were evaluated through the STRASA project, implemented by IRRI and AfricaRice in partnership with national programs in 18 countries and with support from the Bill & Melinda Gates Foundation.

"It's wonderful to see that products of the first two phases of the STRASA project in Africa have now reached the stage to move into farmers' fields," said Dr. Atlin. "I am also impressed by the Africa Rice Breeding Task Force testing network set up in partnership with the national systems as it is a great conduit for moving improved materials into farmers' fields."


SELECTING RICE for cold tolerance.

In addition to the ARICAs, the STRASA project has many other stress-tolerant or climate-smart rice varieties in the pipeline that will be delivered to farmers. The STRASA project uses conventional breeding combined with molecular breeding to develop these kinds of varieties.

"Incorporating stress tolerance into popular high-yielding varieties has proven to be a very effective approach," explained Dr. Manneh.

More than 30 stress-tolerant rice varieties have already been released in nine African countries with support from the STRASA project, according to Dr. Manneh. However, as they were developed before the launching of the ARICA brand, they were not nominated as ARICAs.

Diffusing technology

Through the project, STRASA partners produced more than 15,000 tons of improved seed between 2008 and 2012 and distributed these to farmers. More than a thousand scientists, technicians, and farmers have been trained in improved rice cultivation techniques, seed production, new breeding methods, and seed enterprise management.

"One of the key impact points for STRASA will be the quantity of seed produced and disseminated to farmers," said Dr. Manneh. "As seed production continues to be a major bottleneck in Africa, the main thrust of our recent STRASA meeting was to help countries develop seed road maps."


RICE-CROSSES made as part of STRASA-Africa partnership.

The project is linking up with various partners, including nongovernment organizations such as the Alliance for a Green Revolution in Africa and BRAC, as well as private seed producers such as FEPRODES and NAFASO, for the dissemination of improved seed in Africa. AfricaRice has developed an automated monitoring and evaluation tool to track the diffusion of new technologies.

Multiple tolerance

Sometimes, various stresses, such as salinity, cold, submergence, and iron toxicity, can occur at the same time.

"That's why the third phase of the STRASA project will focus on breeding for multiple stress tolerance," Dr. Manneh explained. The rice varieties that are being developed will help overcome the hurdles imposed by the widespread environmental stresses that limit rice yields in Africa.

"To achieve this, we will strengthen our collaboration with development partners who have the capacity for rapid delivery of improved rice varieties to our farmers," Dr. Manneh added.

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

Country highlight

IRRI and Nepal

by **Paula Bianca Ferrer**

Rice is important to the people and the economy of Nepal, where agriculture employs around 80% of the population and contributes 37% to the country's gross domestic product. Rice is grown on more than 1.5 million hectares, producing a total of about 5 million tons and an average yield of 3.3 tons per hectare in 2011-12.

IRRI-Nepal partnership

The International Rice Research Institute (IRRI) started working with Nepal in 1985. The first collaboration covered rice varietal improvement for rainfed lowland and irrigated fields, plant pathology, entomology, soil science, agronomy, and farming systems. It also involved education and training of Nepalese scientists and technology transfer.

More activities took place after Director General Purushottam P. Gorkhaly of the country's Department of Agriculture and Livestock Services (DoALS) visited IRRI in 1987. IRRI and DoALS carried out rice varietal improvement and related research activities in 1999. The country had also been involved in the activities of the Asian Rice Biotechnology Network and the International Network for Genetic Evaluation of Rice, both based at IRRI headquarters.

Also in 1999, the Nepal Agricultural Research Council (NARC) and IRRI strengthened their partnership for rice improvement in the country. In 2001, NARC and IRRI held a dialogue to develop a project outline to meet Nepal's rice research and development requirements based on farmers' needs and to identify the roles of NARC, IRRI, and other stakeholders in addressing the priority needs.

In 2005, the Nepal-IRRI Country Office was established and the Nepal Rice Knowledge Bank (NRKB) was launched on the NARC website, making 21 fact sheets on rice technologies accessible to extension workers and farmers. In relation to this, three national and four regional training activities for agricultural scientists, extension officers, and NGO personnel were conducted on using the NRKB and developing fact sheets.

From 1980 to 2008, Nepal and IRRI partnered on some projects as part of the Rice-Wheat Consortium for the Indo-Gangetic Plains. These projects became a platform for a range of on-farm and on-station system research supported by the Asian Development Bank (ADB), Department for International Development, the International Fund for Agricultural Development (IFAD), the U.S. Agency for International Development, World Bank, and the Bill & Melinda Gates Foundation, and evolved into the Cereal Systems Initiative for South Asia (CSISA) project in 2009.

From 2005 to 2008, NARC and IRRI completed three collaborative projects funded by ADB and IFAD. The latter supported a project on the management of marginal rainfed uplands focusing on upland and lowland rice. Through this project, community seed production became institutionalized.

ADB supported a project on water-saving technologies, cropping approaches, and other related technologies such as zero tillage. This resulted in a 30–40% reduction in irrigation water use. In addition, ADB supported work on integrated crop management in rice-wheat systems.

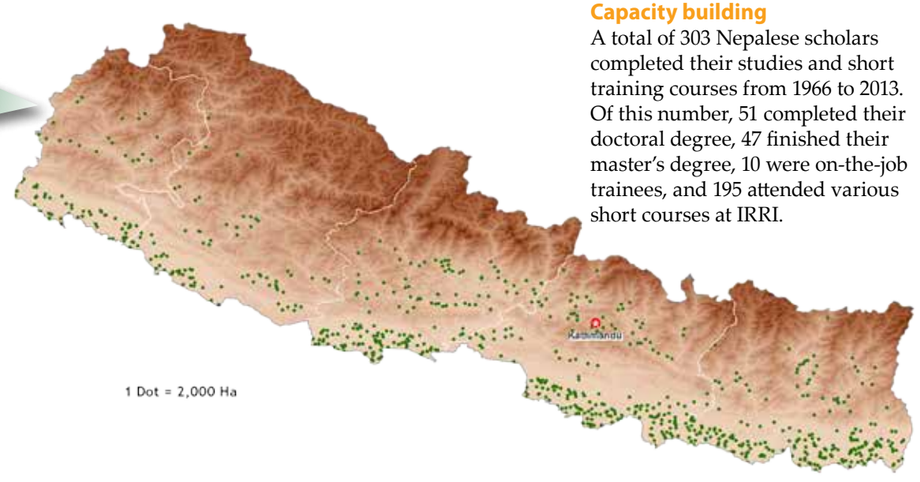
The IRRI-Nepal partnership boasts of key achievements such as improved crop management and productivity, more rice information sources, better rice varieties, and capacity building.

Better ways to produce rice

Nepalese farmers have benefited from reduced labor and costs, less seedling breakage, and increased yield through various modern technologies introduced to them. Some resource-conserving technologies in rice-wheat systems such as zero tillage have advanced wheat sowing by 2–4 weeks, allowing farmers to save 64% of the cost in land preparation and seeding.

Laser land leveling, direct seeding, unpuddled transplanting of rice, and reduced tillage on wheat, maize, lentil, and winter maize have all been adopted by farmers to improve their management practices. Residue management, the use of a leaf color chart for nitrogen management, weed management, rotation with other crops, and other practices have also contributed to higher overall crop productivity.

Seed growers also received training on quality seed production and establishing linkages with resource centers as sources of quality seeds and market information.



Nepal: fast facts

Population: **30.98** million[1]
Total land area: **147,181** sq km[1]
Average rice yield[3]: **2.98** tons per ha
Total rice production: **5.07** million tons[3]
Area planted to rice: **1.53** million ha[3]

[1] CIA, 2014.
[2] World Rice Statistics, 2012
[3] FAOSTAT, 2012.

Better rice varieties

Many IRRI-bred rice varieties for drought and flood tolerance—or climate-smart rice—were successfully tested in Nepal. As a result, three drought-tolerant rice varieties, Sukha dhan 1 (IR71374-46-1-1), Sukha dhan 2 (IR71374 -54-1-1), and Sukha dhan 3 (IR71374-70-1-1), were released in 2011. Similarly, flood-tolerant Swarna-Sub1 and Sambha Mahsuri-Sub1 were also released to help farmers in the southern Terai. To date, NARC has released 69 rice varieties for both irrigated and rainfed environments, with IRRI genotypes contributing more than 60% of the varieties released in Nepal.

Capacity building

A total of 303 Nepalese scholars completed their studies and short training courses from 1966 to 2013. Of this number, 51 completed their doctoral degree, 47 finished their master's degree, 10 were on-the-job trainees, and 195 attended various short courses at IRRI.

Current research work

Developing a seed business model is part of the project in Nepal, in which key seed specialists, government officials, private companies, community groups or cooperatives, and others became involved. The target stakeholders of the project are women, farmers, extension staff, and ethnic minority groups. Another IRRI project aims to enhance the rural poor's access to improved agricultural technologies, especially in stress-prone areas.

In Nepal, the focus is on improving the country's upland rice systems and drought-prone lowlands through participatory varietal selection activities with farmers and introducing improved crop management options. The latter include modern cultivation practices for rice and maize, integrated disease and pest management, resource-conserving technologies, effective use of compost, soil conservation practices, and principles and importance of community-based organizations, among others. The project also includes a seed production component for upland rice farmers and the establishment of community seed banks.

In 2012, the second phase of the CSISA project started in the mid- and far-western regions of Nepal where food deficits were common. CSISA verified different technologies for rice, maize, and lentil production through demonstrations and minikit distribution of seed in those two regions. CSISA also emphasizes the dissemination of technologies and capacity building of extension officers, Department of Agriculture technicians, NARC scientists, and farmers. Moreover, the project focuses on promoting resource-conserving technologies for rice, maize, and lentil.

Breeding hardy rice varieties

IRRI is working with the Regional Agricultural Research Station in Nepal to evaluate promising drought-tolerant rice varieties and to find specific genes that help improve yield under drought. IRRI is also working with many partners to develop new hybrid rice varieties, and, in another project, is generating widely accessible databases on crop improvement for tracking the diffusion of rice varieties. The Bill & Melinda Gates Foundation also supports IRRI in a project that develops climate-smart rice varieties and disseminates them to areas prone to drought and flood.

Many seed companies, cooperatives, and community-based seed producer groups are multiplying seeds of climate-smart rice varieties and making those seeds available locally. Seed companies, cooperatives, agriculture and veterinary service providers, seed producer groups, and rice millers are developing seed networking mechanisms among themselves by organizing workshops and meetings. The Nepal government has taken ownership of this project because of its positive impact in farmers' fields.

What lies ahead

Nepal and IRRI will continue to work together to develop better rice production technologies for both rainfed and irrigated ecosystems, including varietal improvement and best management practices. IRRI will work with NARC in strengthening capacity in hybrid rice, postharvest technologies, socioeconomic and policy research, the rice seed sector, and capacity building of scientists through training activities.

The collaborative program will be pursued under the six themes of the Global Rice Science Partnership (GRiSP), the CGIAR research program on rice. IRRI began linking the dissemination of rice technologies with other bilateral projects related to climate change and food security in the country. And, this work will continue in the future for the wider adoption of climate-smart rice as well as discussions on fund raising on rice research and development for Nepal.

Ms. Ferrer is a science communication specialist at IRRI.

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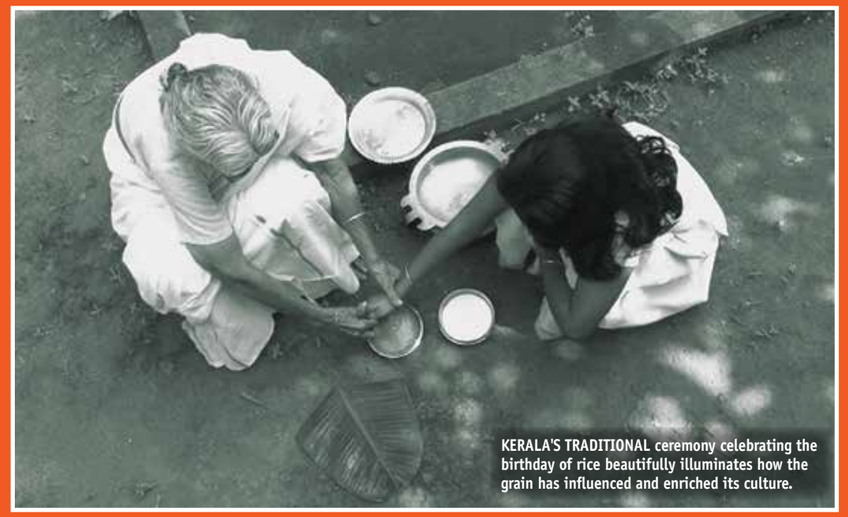

KERALA'S TRADITIONAL ceremony celebrating the birthday of rice beautifully illuminates how the grain has influenced and enriched its culture.

Happy birthday, rice!

by **V. Sankaran Nair** and **Alaric Francis Santiaguel**

Once upon a time, the people of Kerala (India) held a birthday bash for a very special celebrator: rice

In Malayalam, the predominant language spoken in the Indian state of Kerala, Regulus, the 10th asterism, consists of a sickle shaped group of stars in the front of the constellation of Leo. This auspicious pattern of stars symbolizes good fortune, happiness, wealth, and charity. In Kerala, *makam* in the month of *Kanni* (September-October) is a day marked to honor rice. In many regions of Kerala, it is observed as *dhanyasamridhi*, the harvest festival.

But, in southern Travancore, the day is celebrated as the birthday of rice, a ritual found nowhere else. This devotion to rice begins with the plowing and sowing ceremony in April or May and culminates during harvesting from September to October.

Rice takes a holiday

The rice grain becomes an object of worship by grateful people among rice farmers all over Kerala on the day of *makam* (the 5th of October). The paddy grain enjoys complete rest, as no one tills or plows the land, boils paddy, pounds rice, or barters or trades in rice on that day. Rice is pampered instead, through various birthday rituals that have been passed on from generation to generation.

Pomp and pageantry

Wearing ceremonial clothes after a ritual bath, the head of the family, a maternal uncle, or a maiden born under the *makam* randomly gathers seven grains of rice that fall from the sheaf of harvested rice from the pathway as they are carried home on heads from the fields.

Some of the collected grains may contain pests. By throwing back one such grain at the place from where it was picked up, and another grain at the conduit through which water is let into the field or in the household well where it was given a ceremonial bath, this ensures a balance of five healthy grains.

From grains to a goddess

These five grains, anointed with sacred ashes, sandalwood paste, and *kumkum* (a powder made from turmeric or saffron), are placed with great reverence, on a sacred cloth on a sacred platter or tray known as *taalam*. The Malayalam word *taalam* means the throne of Durga. In a way, the ritual symbolically enthrones rice grains to goddess-ship.

In some other places, the grains are placed either on the end portion of a plantain (*Musa paradisiaca*) leaf or on seven leaves of the strychnine tree (*Strychnos nux-vomica* L.). The former plant is associated with the Hindu goddess *Parvati*, the consort of Lord Shiva, and the latter with rice cultivation as the plow and granary are made from its wood.

After offering flowers and a lighted lamp, the *taalam* is taken to a chamber found in traditional houses, called the *thekkepura*, accompanied by a chorus of the household women. As an homage to the goddess, incense is burned to purify the air in the room.

The goddess is fond of *paachoru*, a rice pudding made by boiling rice with milk, sugar, jaggery, rice, coconut, and turmeric. Household women in a state of purity cook this dessert and, after offering it to the goddess, they serve it to the farm workers and family members.

Fading glory

Unfortunately, this unique birthday celebration has all but faded from Kerala's tapestry of traditions. In the seventies, the rice-based agriculture in Kerala shifted to other crops, as rice production in other Indian regions increased. The lack of farm workers in the state also contributed to the changing landscape.

With the disappearance of the once gloriously verdant rice farms of Kerala, the celebration of this ritual dwindled and now takes place only in a few isolated places.

The birthday ritual is seldom observed these days, lamented Gourikutty Amma, a long-time resident in Kerala who still lives in the roughly 500-year-old house of her ancestors that faces the erstwhile rice fields.

Eighty-six-year-old Gopinathan Nair (passed away recently) remembered his heyday of youth when he witnessed his father performing the ritual of rice's birthday and later doing it himself. However, ever since rice cultivation in Kerala diminished, he had to discontinue this practice, which was handed down to him by his forefathers.

The article is adapted from Dr. Nair's upcoming book Traditional houses of Travancore: A gateway to prehistory. *His recent book,* Rice: in Ancient Kerala *(Kerala Sahitya Academy, Trichur) devotes a chapter describing the celebration around the birthday of rice which falls on Regulus, in Virgo, the sixth sign of the zodiac. This enabled him to work out the astronomical alignment, and fix the year of birth of this practice to 3102 BC. Apart from Regulus, he explores in this book two more asterisms; Orion as the plough star and Sirius as the dog star.*

Dr. Nair is an academic and Indologist; Mr. Santiaguel is associate editor and writer for Rice Today.

Bitter harvest from a noble cause

by **Robert S. Zeigler**

Dr. Zeigler, director general of the International Rice Research Institute (IRRI), reflects on the Green Revolution and fears that anti-technology zealots may steal the food from the mouths of future generations

GENE HETTEL 1

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Norm Borlaug had no illusions that the Green Revolution was anything other than a means to buy the world time. Time—to get our house in order to stabilize our populations, generate the knowledge that would allow us to support ourselves without destroying the environment, and enable most people to live in dignity. The expectation, he told me in several conversations in the early 2000s, was that we as societies would take up the new knowledge and use it wisely.

As an intellectual direct descendent of the architects of the Green Revolution, it is heartbreaking to see their noble endeavors attacked by people claiming to defend the environment and the interests of the poor. I know that, if we continue to listen to the shrill cries of anti-technology zealots, we will be distracted from taking on and solving the most serious problems that face us and our grandchildren.

Like many of my colleagues, I came to agriculture via the environmental movement. My university readings included Rachel Carson, Aldo Leopold, Muir, Thoreau, the *Whole Earth Catalog*, and, perhaps most importantly, Paul Ehrlich and the Paddock brothers, whose bestselling books predicted mass starvation in Asia. Being part of the organization of the first Earth Day (22 April 1970) at the university was key, as was a sense of social justice. My mother's side of the family dug themselves to their deaths mining the coal seams of western Pennsylvania. That, together with the war in Vietnam and the global social upheaval of the 1960s, instilled a healthy distrust for authority and big business, and a knee-jerk response whenever possible to "stick it to the man."

As a Peace Corps volunteer in Zaïre (now known as Democratic Republic of the Congo), I saw close-up the havoc unleashed by an epidemic in the cassava crop. I witnessed the ecological destruction as villagers desperately slashed and burned swaths of tropical forest to meet immediate food needs. I was preparing myself for a career in plant ecology, but the misery caused by crop diseases was clear. They could be triggered by human mistakes and ecological disruptions, but they could also be tackled through human ingenuity and science.

I made contact with the only person in the U.S. I could locate with an interest in cassava diseases, Professor H. David Thurston at Cornell University. It turned out he was a contemporary and close colleague of both Borlaug and Peter Jennings—who developed the first semidwarf rice varieties that launched the other half of the Green Revolution. Dave opened the door for me to international agricultural research. He also regaled me with endless tales of the personalities who, trudging their way through small farmers' fields in the 1950s and 1960s with funding from the Rockefeller Foundation, strove to transform the lives of desperately poor farmers.

> All these greats had something in common. A fire in the belly to try to make a mockery of the doomsday predictions.

All these greats had something in common—a fire in the belly to try to make a mockery of the doomsday predictions of Ehrlich (*The Population Bomb*) and the Paddock brothers (*Famine 1975*). The flaw in these predictions was obvious to me, even as a student. They assumed that the future would be like the past. The role of science was *precisely* to make the future different from the past.

Soon, I was to meet one of these greats, Peter Jennings, at the International Center for Tropical Agriculture (CIAT) in Cali, Colombia, where I would conduct part of my

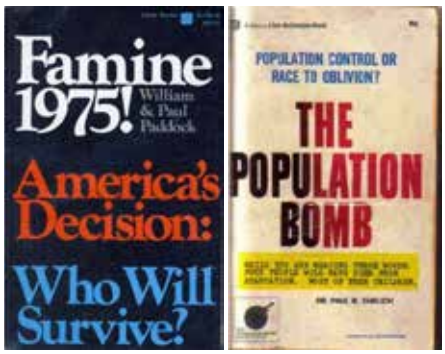
1. **ON 25 MARCH 2014, the agricultural world celebrated what would have been the 100th birthday of Norman Borlaug (at center with trainees in Mexico in the early 1990s), the legendary scientist who developed high-yielding semidwarf wheat that started the Green Revolution for that crop.**
2. **DR. ZEIGLER (*fourth from right*) and IRRI staff interact with farmers on their turf whenever they can.**
3. **PETER JENNINGS, IRRI's first breeder, had a hand in history too by making the cross that led to IR8, the semidwarf variety that started the Green Revolution for rice.**
4. **SUBMERGENCE-TOLERANT variety Swarna Sub1 is drastically changing the lives of farmers in the flood-prone areas of eastern India.**

PhD research on a cassava disease. We argued endlessly about the best approach to developing lasting resistance to plant diseases. He was proud of the advances he and his colleagues had made in raising rice yields in Asia and Latin America but saw that, for these to be sustained, and for the overall health of the environment, the way crops were grown had to change (see *Where Latin America's rice gets a baptism by fire,* pages 24-25).

By the late 1970s and early 1980s, the shortcomings of the early phase of the Green Revolution were becoming clear. The most serious were the overuse of pesticides and fertilizer, and the inevitable transformations of the rural sector, where many, many gained but some, especially those in marginal environments, lost out. A backlash began among leftist academics who viewed the Green Revolution as a way for capitalist governments and multinational corporations to subjugate small farmers. This view was helped by the fact that some oppressive West-leaning governments were avid champions of the Green Revolution.

As the worst examples of the Green Revolution's side effects became

IRRI ARCHIVE



URBITO ONGLEO

manifest, environmental concerns became part of the mainstream consciousness, culminating ultimately in the United Nations Rio conference of 1992. But that conference framed a false dichotomy that continues to this day, between a healthy environment and idyllic, contented farmers on one side and a high-yielding agriculture on the other.

I began to experience cognitive dissonance. My firsthand experience with impoverished small farmers in the developing world was placing me at odds with my ideological brethren.

Our understanding of genetics and the ability to proactively manipulate how plants behaved and responded to the environment was becoming a reality. Many of us saw this as a way to reverse the negatives of the Green Revolution and open the way for, in the words of Sir Gordon Conway, a "doubly green revolution."

> We could now help the people left behind because they lived on lands plagued by droughts or floods that wouldn't support modern crop varieties.

It was easy to see that we could engineer into crops resistance to insect pests and pathogens that would eliminate the need for spraying toxic chemicals that sickened every organism they touched. Even better, we could now help the people left behind because they lived on lands plagued by droughts or floods that wouldn't support modern crop varieties. I have seen this dream validated. India's untouchable communities (the lowest class) often farm on marginal flood-prone land. IRRI's flood-tolerant rice is most useful to these farmers and promises to transform the lives of millions.

In short, we saw modern biology as a driver for transforming agriculture into a tool for protecting the environment, meeting food needs, and reversing millennia of injustices that condemned certain segments of the population to the worst land.

Sadly, while we were working to make our dreams reality, the strange brew of anticorporate sentiment,

ADAM BARCLAY

extreme environmentalism, romanticized traditional organic but land-hungry agriculture, and fear of new technologies boiled over to create a powerful antitechnology backlash. The extreme regulations for genetically modified (GM) crops demanded by self-proclaimed protectors of the environment had the perverse result that only the largest multinationals could afford to develop such crops. Predictably, this resulted in the same camp denouncing the growing domination of agriculture by multinationals. As costs for developing crop varieties escalated, the few seed companies that could afford the work focused only on areas with large markets. Marginal farmers were once again excluded.

This time, though, who is to blame?

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An interview with

Peinda Cissé

Senegal's mother of modern rice farming

by **Savitri Mohapatra**

Peinda Cissé proves that rice farming is not just a man's world anymore

R RAMAN, AFRICARICE (3)

The rice connection

I was born in Saint Louis, which is located in the northwest of Senegal, near the mouth of the Senegal River. This region is endowed with enormous natural resources and is the country's irrigated rice belt.

Later, I moved to the neighboring town of Richard Toll, which also has strong links to rice. The town is named after Jean Michel Claude Richard (1787-1868), a noted French botanist, who established an experimental garden, where he conducted for the first time irrigated rice trials in Senegal. "Toll" in the local language Wolof means garden.

In 1949, the French initiated a rice-growing scheme in Richard Toll on 6,000 hectares for exporting to Europe. But, in the 1970s, the crop lost its predominance in that area because of a lack of government support. Richard Toll is now more known for its sugar industry. To me, this has been a big loss for rice development.

From accounting to seed production

I started work as an accountant in the French Institute for Tropical Agricultural Research (IRAT), which later became known as CIRAD, the French Agricultural Research Centre for International Development. My boss was a dedicated rice geneticist who encouraged me to learn everything about rice cultivation. I soon became a rice enthusiast and first started growing the crop on a 1-hectare area.

I was told that it would be difficult for a woman to become a successful rice farmer, but I persisted. I took up rice seed production in 1973 and became president of the National Union of Professional Seed Producers in Senegal (UNIS) in 1994, and served as president until 2000. During that period, I was contacted by the Senegalese National Agricultural

Portrait of a woman as a pioneering rice farmer

In 1996, when the Senegalese National Agricultural Research Institute (ISRA) was desperately looking for seed production specialists who could produce high-quality foundation seed of all the rice varieties released in the country, it turned to rice seed producer Madame Peinda Cissé. She rose to the challenge, thus opening the world of rice farming to women.

Madame Cissé is the founder-president of FEPRODES, a farming women's association that brings together thousands of women involved in rice seed development to get better access to credit, technologies, and trade opportunities.

The seed produced by FEPRODES has been distributed in Mauritania and Guinea Bissau to reactivate rice production in those countries after civil conflicts. The association has multiplied seed of all the popular "Sahel" rice series, including aromatic varieties developed by AfricaRice and its partners.

FEPRODES has its own training center for seed production and a microcredit system and has helped increase the income and improve the quality of life of its members, lifting them from being the most deprived and poverty-stricken in rural society.

Recognizing Madame Cissé as a leading and inspiring figure for women seed producers in West Africa, the Third Africa Rice Congress held in October 2013 in Yaoundé, Cameroon, presented her with the Outstanding Rice Entrepreneur Award for Seed Production.

She is also a co-recipient of the 2003 Presidential Prize for Science and Technology in Senegal for the development of the ASI thresher-cleaner, which is now widely used in several African countries.

Research Institute (ISRA) to produce foundation seeds of all the rice varieties released in Senegal. UNIS took over that job in 2000.

In 1998, we produced 105 tons of seed of improved rice varieties developed by Africa Rice Center (AfricaRice) and its partners for Mauritania. Similarly, we produced more than 140 tons of seed for Guinea Bissau, which helped that country to revive its rice industry after the war.

An activist for rural women

In Senegal, like in other parts of Africa, rural women traditionally do not have access to agricultural land. Hence, they are obliged to rent land. But, once they develop it for farming and it becomes profitable, the owner takes it away from them. This is the general pattern. To empower these women, we established a federation in 1997.

This federation, known by its French acronym FEPRODES, has more than 38,000 members involved in agriculture in Saint Louis. FEPRODES provides training in improved farming and postharvest techniques, computer science, gender mainstreaming, leadership, and management of small enterprises for its members.

We soon realized that, without microcredit, it would be difficult for our members to reach their goal. So, we created a microcredit facility attached to FEPRODES to serve primarily our members. I'm proud to say that, in 2012, out of 234 microcredit facilities evaluated for the quality of their service, ours was ranked sixth in the country.

As most rural women are very poor, we kept the minimum amount for opening an account in FEPRODES to just 50 F CFA (US$0.10). We encouraged our members to form small associations for obtaining credit from us. In most cases, the women pay back their loans on time. Unfortunately, this is not the case with the men. Right now, we have a huge crisis of unpaid loans.

THE WOMEN'S association FEPRODES selling quality rice under the brand 'Rizchard'.

Association with research and development partners

I was an active member of the former rice network for West and Central Africa (ROCARIZ) and the African Rice Initiative convened by AfricaRice. We maintained close links with ISRA and AfricaRice for training and seed production. We were also closely involved in AfricaRice's participatory varietal selection (PVS) activities, which bring farmers in direct contact with new rice varieties under development.

Members of FEPRODES have been trained in quality rice production with support from USAID.

In 2009, based on the recommendations of AfricaRice and demand from farmers, the government of Senegal passed a decree that varieties selected by farmers in PVS activities can henceforth be released in the country without going through the formal lengthy evaluation process of the national variety release committee. Sixteen new rice varieties selected by farmers were immediately released for large-scale cultivation.

We are also greatly benefiting from the recent release of three aromatic rice varieties developed by AfricaRice. There is a big demand for quality rice, particularly aromatic rice, in Senegal, for which clients are ready to pay a premium price.

With support from USAID, we are focusing on the production, branding, and marketing of quality rice and our rice is now being sold under the *Le Richard* brand. The World Food Program recently bought 100 tons of rice from us as part of its new policy of purchasing local rice for distribution.

Message to the government

Like other African countries, Senegal had marginalized agriculture for a long time. That is why we are relying heavily on rice imports to meet our demand despite having good potential for production. We strongly support the current government's strategy to boost rice production and become self-sufficient by 2017.

I urge the government to give more land to women farmers, because they have shown that they are capable of successfully producing rice. This will also greatly help the government in solving the unemployment problem because women farmers can generate employment.

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

Rice in South Asia


ISAGANI SERRANO

by **Samarendu Mohanty**

Rice is a staple for the majority of the 1.7 billion South Asian population and a source of livelihood for more than 50 million households. Apart from its economic and strategic importance, rice is deeply engraved in the rich tradition and culture of many South Asian countries. In India and Nepal, rice offerings to bring good health and prosperity to family members are common on many auspicious occasions. The significance of rice extends beyond life for Hindu communities in the region with offerings given to the departed soul. Similarly, in Sri Lanka, during the marriage ceremony, known as *Poruwa*, the bride and groom are placed on the top of paddy to bring fertility to the couple. One can find many religious and cultural uses of rice or paddy throughout South Asia.

The region cultivates rice on 60 million hectares and produces slightly above 225 million tons of paddy, accounting for 37.5% of the global area and 32% of global production in 2013.[1] Within South Asia, both India and Bangladesh are major rice-growing countries. India has the largest rice area in the world with 43 million hectares (more than a quarter of the global rice area) and contributes a little less than a quarter of global production. Bangladesh has more than 11 million hectares of rice area and produces 50 million tons of paddy.

The other three rice-growing countries in South Asia—Pakistan, Nepal, and Sri Lanka—together have slightly above 5 million hectares of rice area and produce 17 million tons of paddy. Current paddy production in South Asia is more than 300% more than what it was at the start of the Green Revolution in the late 1960s. The majority of this production increase in the past five decades has come from yield growth, with harvested area growing by only 20% from 50 million hectares in the late 1960s to 60 million hectares now.

During this period, production has been able to keep up with population growth, with a steady increase in per capita production between the mid-1970s and mid-'90s by more than 10 kilograms, before flattening out and then starting to rise again in the past few years (Fig. 1). An overlay of per capita consumption on per capita production reveals that consumption followed the upward trend in production until the early '90s. But, after that, per capita consumption declined for a few years and then stabilized at 80–82 kilograms in the past 15 years—making South Asia a growing exporter of rice.

South Asian rice exports increased from 2 million tons in the early 1990s to 14 million tons in 2013 (Fig. 2). Apart from India, the largest exporter of rice in the world, Pakistan's rice exports have been steadily rising for the past three decades, reaching 4 million tons in recent years. On the import side, two South Asian countries, Bangladesh and Nepal, import a small amount of rice, 1–2 million tons annually. In the past few years, imports have fallen below 1 million tons primarily because of favorable weather in the region.

Despite some impressive production growth in the past five decades and the growing status as one of the largest rice-exporting regions in the world, South Asia was still home to 295 million undernourished and hungry people in 2011-13—nearly 35% of the 842 million hungry people in the world.[2] In 2011-13, 16.8% of the people in South Asia were hungry. This is the highest percentage among other Asian regions and is second highest behind Africa, but this is much lower than the 25% hungry people South Asia had in 1990-92.

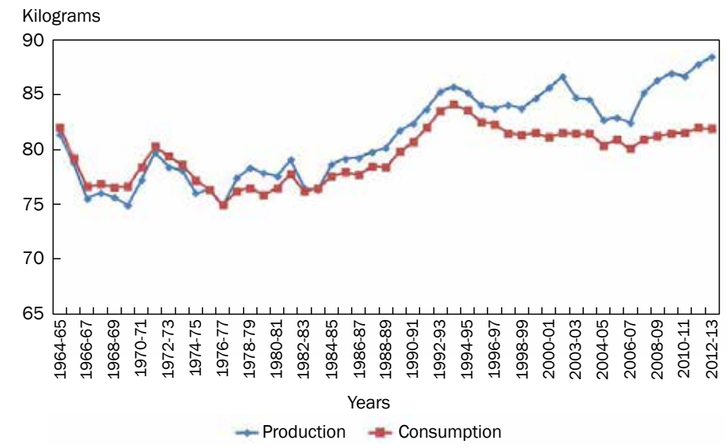

Fig. 1. South Asian rice production and consumption on a per capita basis.*
*5-year moving average
Data Source: USDA & UN

Future food security challenges

As we move forward, the South Asian population is projected to surpass 2 billion by 2030, or 300 million additional mouths to feed, in the next 15 years.[3] But the good news is that, as income rises, more and more people are likely to diversify their food basket from rice to more high-value products such as fruits and vegetables, meat, and milk and dairy products. In other words, per capita rice consumption, which has been flat for the past 15 years, may decline in the future with the rise in income and urbanization. Since most of the South Asian population is vegetarian, the rate of diversification is likely to be much slower than what has been witnessed in other parts of Asia. In addition, the diversification rate in many South Asian countries may be slowed down because of government interventions with price controls and subsidized food grain distribution.

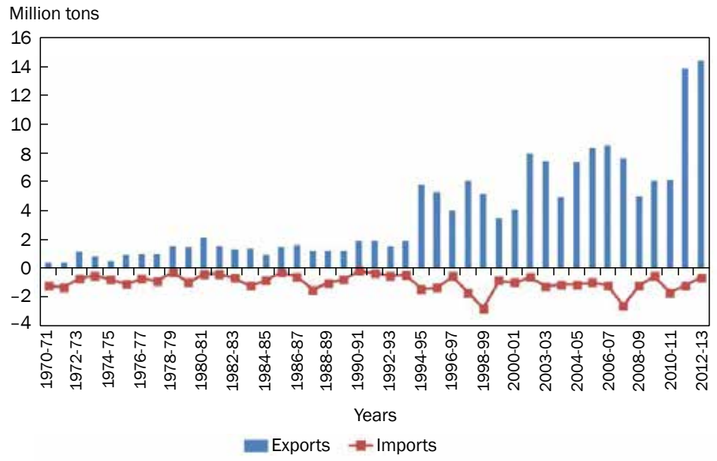

Fig. 2. South Asian rice trade.

India is a good example where the government has rolled out an elaborate food subsidy program to provide highly subsidized food grains (rice and wheat) for 65 million below-poverty-line households, including nearly free food grains to 20 million Antyodaya Anna Yojana households, the poorest of the poor households. Each of the 65 million households receives 35 kilograms of grain every month at 74–86% below the procurement cost.

Assuming that per capita consumption remains flat in the next 15 years, then total consumption will grow at the present population growth rate of 1.3% and eventually will fall below 1% by 2030 as population growth slows down. However, if South Asian countries follow a rapid diversification path, total consumption could flatten out by 2030.

On the supply front, it does not sound alarming that South Asia needs to match its production growth with the slowing population growth for future food security. Given that rice area will not further expand in the region, achieving a yield growth of 1% to 1.3% sounds reasonable. But, there are many glaring uncertainties such as growing water shortages, imbalanced fertilization, competition for rice land from nonagricultural uses and biofuel crops, increasing frequency of extreme weather,

[1] PSD Online Database, USDA.

[2] FAO, IFAD, and WFP. 2013. The State of Food Insecurity in the World 2013: The multiple dimensions of food security. Rome, FAO.
[3] World Population Prospects: The 2012 Revision, published by the United Nations.

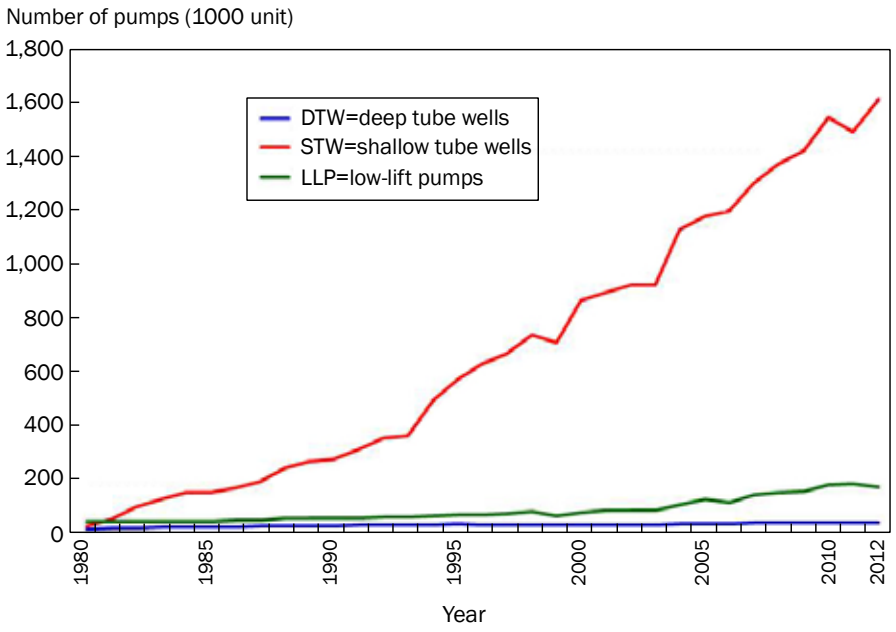

Fig. 3. Pump irrigation in Bangladesh, 1980-2012.
Data source: DAE, Ministry of Agriculture, GOB

and emerging pest outbreaks due to climate change that can make things even more challenging. Rapid depletion of groundwater in parts of India and Bangladesh is of serious concern for future productivity growth. In Bangladesh, the *boro* rice crop (dry-season crop, which largely depends on irrigation) now accounts for 40% of the total area (4.75 million hectares out of a total area of 11.65 million hectares) and contributes 55% of the total paddy production of around 51 million tons. According to the 2013 Bangladesh Grain and Feed Annual published by USDA,[4] the water table in certain parts of Bangladesh is dropping by 4 to 5 feet (1.2 x 1.5 meters) per year because of the expansion of irrigation. The extent of groundwater use can be gauged by the exponential rise in the number of shallow tube wells from 21 in 1980 to about 1.62 million in 2012 (Fig. 3). Similar to Bangladesh, many rice-growing states in India (such as Punjab, Haryana, Uttar Pradesh, and Andhra Pradesh) are facing declining water tables because of intensive rice-wheat and rice-rice cultivation.[5]

Imbalanced fertilizer use in favor of nitrogen, due to subsidy and ignorance of farmers on the benefits of balanced fertilizer application, is adversely affecting soil health and is a major concern for future productivity growth in South Asia.[6] Things have improved in India over the years in terms of the imbalance in fertilizer application from an NPK use ratio of 7.9:0.9:1 in 1951 to 4.3:2:1 in 2010, which is closer to the recommended ratio of 4:2:1, according to the report. However, in Bangladesh, things have moved in the opposite direction, with the share of urea in total fertilizer rising from 64% in 1981 to 89% in 2010.[6]

A combination of appropriate policy reforms, the development and dissemination of climate-resilient and resource-conserving technologies such as stress-tolerant or "climate-smart" rice varieties (tolerant of flood, drought, and salinity), and improved production practices including site-specific nutrient management, alternate wetting and drying, and direct-seeded rice can ensure South Asia's sustainable food security in the future.

A major overhaul of policies is long overdue in the region, which still uses price support for farmers, procurement and redistribution of grains, and border policies to control the flow of rice in and out of the country. These policies that are directed toward reducing market risk played a crucial role in expanding rice production in the past five decades and in achieving self-sufficiency in South Asia. However, on the negative side, these policies have been a growing pain to the state exchequer. For example, the Indian fertilizer subsidy bill increased from less than US$6 billion in 2006-07 to close to $12 billion in 2011-12. The fertilizer subsidy in Bangladesh skyrocketed in recent years because of high international prices, from 3,895.7 crore taka ($569 million) in 2007-08 to 11,456.7 crore taka ($1.47 billion) in 2011-12. This represents more than a 150% rise in 4 years since making a comeback in 2006 (Jahangir Elam presentation on the fertilizer sector in Bangladesh).[7]

The collapse of the Thai mortgage scheme is a good example of how market-distorting programs cannot be sustainable in terms of rising cost over time. Apart from rising cost, these policies have led to excessive and/or imbalanced use of many inputs such as water, fertilizer, and pesticide.

The 21st century policies should aim at supporting farmers without causing much market distortion, and encourage the efficient use of water, fertilizer, and pesticide, among other inputs. Government policies should also be directed toward providing incentives for the rapid adoption of resource-conserving technologies and climate-smart varieties to overcome the negative effects of climate change and improve the sustainability of rice production systems.

Dr. Mohanty is the head of the Social Sciences Division and program leader (Targeting and policy) at IRRI.

[4] http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Annual_Dhaka_Bangladesh_3-28-2013.pdf.
[5] 2014 India Grain Feed Annual, USDA.
[6] Mujeri MK, Sahana S, Chaudhury TT, Haider KT. 2012. Improving the Effectiveness, Efficiency and Sustainability of Fertilizer Use in South Asia. Policy Research 8, Global Development Network.
[7] www.slideshare.net/resakssasia/dr-mohammad-jahangir-alam-bangladesh-fertilizer-sector.

India makes access to food a right, not a privilege

BY RITA SHARMA

In September 2013, India's parliament passed the National Food Security Act (NFSA), which, when fully operational, will be the world's largest subsidized food program. It is a very ambitious program that provides access to subsidized food grains for around two-thirds (810 million) of the country's population of more than 1.2 billion people—the food being provided solely from Indian cereal and coarse grain (various types of sorghum and millet) production at an estimated annual cost of US$20–22 billion. Over the years, the Indian government has, through its Public Distribution System, provided subsidized food to households living below the poverty line. Now, the NFSA guarantees it.

I believe that one of the most important elements of the NFSA is its potential to empower millions of women as it is based on a life-cycle approach. In addition to a per capita monthly food grain quota, it entails providing further highly subsidized rations for pregnant and nursing mothers from the poor segments of society. They can obtain food and a guaranteed minimum of 1,000 rupees ($16) per month for 6 months—3 months before and 3 months after their child is born. During this period, it is difficult for women to go out and do hard labor to earn their daily wage. Furthermore, under the NFSA, women are designated as "head of household" on ration cards, which enhances their status in the family.

The next stages, through Integrated Child Development Services, cater to children between the ages of 6 months and 3 years, and then 3 and 6 years. Before the NFSA was passed, these programs already existed in various forms, which provided (1) special centers where mothers on their way to work could leave their young children to receive nutritious meals, and (2) mid-day meals for children from 6 to 14 years old as part of a nationwide school feeding program, which benefits more than 120 million children. Now funded under the NFSA, these programs are guaranteed for the first time.

For the last quarter century, India has usually produced more than enough rice, wheat, and coarse grains to feed its people. The challenge in fulfilling the ambitious requirements of the NFSA is managing the distribution of the food to more than 810 million people, using the huge existing—but sometimes inefficient—network of farmers, buyers, storage facilities, and fair-price shops. A major exercise to reform the system of grain procurement and distribution is currently underway with a mandate through the landmark NFSA to make the system work efficiently.

And, of course, we could never have a viable NFSA if it depended on imports. The government proposes to distribute about 62 million tons of locally produced food grain (excluding pulses) each year through the Public Distribution System under the NFSA. India's 12th Five-Year Plan, ending in 2017, has aims to increase food grain production by an additional 25 million tons. For this, the target is to increase rice production by 10 million tons, wheat by 8 million tons, coarse cereals by 3 million tons, and pulses by 4 million tons.

So, for rice and wheat, respectively, entering the stage in a big way are the International Rice Research Institute (IRRI) as leader of the CGIAR's Global Rice Science Partnership (GRiSP), the International Maize and Wheat Improvement Center (CIMMYT) as leader of the CGIAR Research Program on Wheat, and associated networks such as the Cereal Systems Initiative for South Asia (CSISA) and Stress-Tolerant Rice for Africa and South Asia (STRASA).

Even more important than increasing cereal production per se is assuring that the cropping systems that are in place are sustainable. Indian farmers, who now must produce their critical harvests with less water and labor, under the looming menace of climate change, have learned how to adapt over the centuries. So, it will be important for CGIAR researchers to tap into farmers' indigenous knowledge to meet future cereal production goals.

Finally, I want to make it clear that the Indian farmers of the future will undoubtedly not be using all of their land only for food grain production. As incomes increase, we now have almost 250 million Indians in a growing middle class, who are demanding more fruit, vegetable, and dairy and poultry products in their diets. So, since less of our cultivable land will be devoted to growing rice and wheat, it will be critical that CGIAR, through IRRI, CIMMYT, CSISA, and STRASA, work with farmers to increase productivity where cereals continue to be grown—thus enabling the government to meet its NFSA targets.

Dr. Sharma is a member of IRRI's Board of Trustees, 2011-15, and secretary to the National Advisory Council of the government of India.

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