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Rice Today

International Rice Research Institute
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2013 CALENDAR INSIDE

The first lady of rice

Farmers capture success on video

Moisture meters at a lower cost

A millionaire farmer's story

Young brains in rice biotechnology

Rice fable from China

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contents

About the cover. The ladybird beetle (*Micraspis* sp.) is one of the beneficial insects that protect rice plants from serious pests. It is active during the day and forages for food in the upper half of the rice canopy in dryland and wetland habitats. This voracious predator feeds on aphids, mites, leafhoppers, stem borers, planthoppers, thrips, and other small soft-bodied insects (photo by Isagani Serrano).

Rice Today is published by The Rice Trader Inc. (TRT) in association with the International Rice Research Institute (IRRI).

TRT, for 22 years, has brought subscribers crucial, up-to-the-minute information on rice trade through its weekly publication, *The Rice Trader*. Acknowledged as the only source of confidential information about the rice market, this weekly summary of market data analysis has helped both the leading commercial rice companies and regional government officials make informed decisions, which are critical in today's market.

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 (www.cgiar.org).

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Spreading our roots

As always, *Rice Today* is at the forefront of bringing you breaking research news. In this issue, we share some research published in *Nature* on the discovery of the *PSTOL1* gene that helps rice grow bigger and better roots to take up more phosphorus and boost yields.

But, rice farming is more than just targeting higher yields. In "Eyes on the Prize," we examine the complex decisions farmers have to make to help ensure they get higher profits—it is not as simple as just relying on high-yielding varieties. Plus, a farming couple from the Philippines tells their story about how their rice-farming enterprise has returned a profit.

Making complex decisions to turn a profit can be made easier when farmers are supported by learning alliances that allow them to test new technologies and adapt them to their local conditions. IRRI's Dr. Bas Bouman, also the new director of the Global Rice Science Partnership, takes a fresh look at the System of Rice Intensification in the "Grain of Truth" and its potential as a learning alliance to bring farmers together to share knowledge.

Bringing farmers together is at the heart of the Digital Green project in which Indonesian farmers are producing their own videos to share their best management practices for direct seeding to learn from each other.

Our country highlight this issue focuses on Lao PDR as does "What's cooking?" with a recipe for Laotian steamed sticky rice with eggplant dip.

In our cover story, lady beetles are given center stage for their role in controlling pests, while our maps section shows us where pests and diseases do the most damage across Asia. Over in Africa, there is some hope in tackling the continent's biggest disease challenge—rice yellow mottle virus—which is covered in both our news section and our article about Africa's fresh batch of biotechnology graduates.

To turn to news closer to home, this issue marks the end of an era as this is the last *Rice Today* for which our partner—The Rice Trader (TRT)—will serve as the magazine's publisher. TRT joined *Rice Today* back in 2008 to help move the publication forward and support its ongoing production and distribution. During our time together, we experimented with advertising in *Rice Today,* developed *e-Rice Today*, got our first articles translated into Spanish and French, upgraded our Web site presence, initiated the Editorial Board, expanded our coverage into other areas of rice, and connected with rice traders at TRT conferences.

I would like to say a special word of personal thanks to the TRT team for their contributions: Aileen Macalintal, the current editor; Mia Aureus, the previous editor; V. Subramanian, the managing editor; and Jeremy Zwinger, the publisher. Jeremy led the way in opening up our relationship and pushed us to think outside our previous box. Subra has provided us with a constant buzz of energy and ideas and organizational skills to keep the magazine on top of its game. Mia and Aileen (more recently) have done all the hard work—providing their hands-on writing and editing skills and helping ensure the magazine was delivered every quarter packed full of great content.

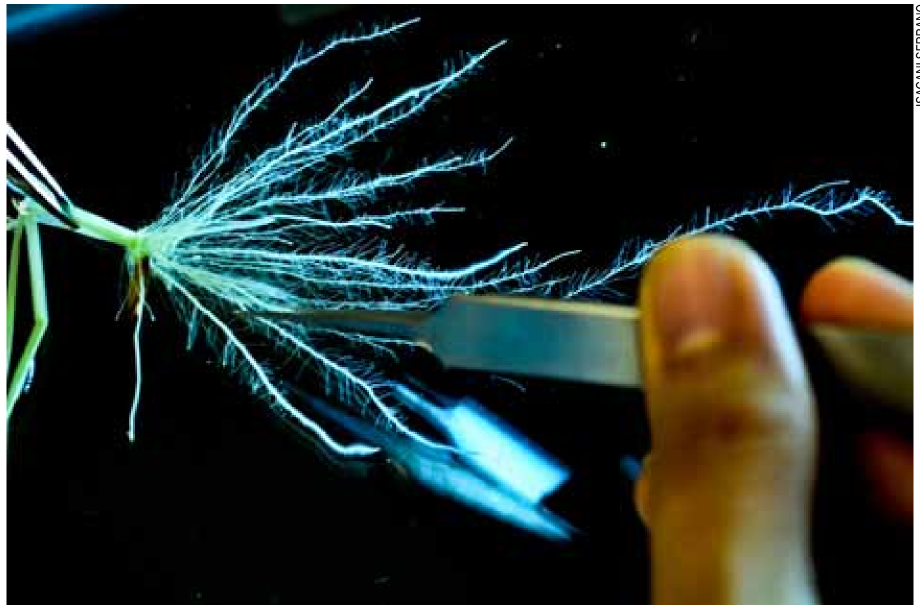
We are very much looking forward to continue working with TRT, who, we hope, will join us in an ongoing capacity on the *Rice Today* Editorial Board, where their contributions and special rice-trading perspective will be highly valued.

Thanks, TRT, from all of the *Rice Today* team!

Sophie Clayton
Rice Today associate publisher

News

Rice gene boosts phosphorus uptake



ISAGANI SERRANO

ROOT CLOSEUP: the *PSTOL1* gene helps rice grow bigger and better roots to access more phosphorus to power a 20% increase in yields on problem soils.

Scientists have pinpointed a gene that enables rice plants to produce around 20% more grain by increasing uptake of phosphorus, an important, but limited, plant nutrient.

The discovery unlocks the potential to improve the food security of rice farmers with the lowest value phosphorus-deficient land, allowing them to grow more rice to add to global production, and earn more.

The gene—called *PSTOL1*, which stands for phosphorus starvation tolerance—helps rice grow a larger, better root system and thereby access more phosphorus. Farmers can apply phosphorus fertilizers to increase productivity but, on problem soils, phosphorus is often locked in the soil and unavailable to plants.

Also, phosphorus fertilizer is often unaffordable to poor farmers. Adding to the problem is that phosphorus is a nonrenewable natural resource and rock phosphate reserves—the source of most phosphorus fertilizers—are running out.

"For many years, we have searched for genes that improve phosphorus uptake," said Dr. Sigrid Heuer, senior scientist at the International Rice Research Institute (IRRI) and leader of the team that published the discovery in *Nature*.

"We've known for a long time that the traditional rice variety Kasalath from India has a set of genes that helps rice grow well in soils low in phosphorus," she added.

Kasalath's superior performance under phosphorus deficiency was initially discovered by Dr. Matthias Wissuwa from the Japan International Research Center for Agricultural Sciences. He then started collaborating with IRRI and shared the DNA information of Kasalath. The current research was supported by the CGIAR Generation Challenge Programme.

The *PSTOL1* gene discovery unlocks the potential to improve the food security of rice farmers with the lowest value phosphorus-deficient land.

"We have now hit the jackpot and found *PSTOL1*, the major gene responsible for improved phosphorus uptake and understand how it works," Dr. Heuer said.

The discovery of the *PSTOL1* gene means that rice breeders will be able to breed new rice varieties faster and more easily, and with 100% certainty their new rice will have the gene.

"In field tests in Indonesia and the Philippines, rice with the *PSTOL1* gene produced about 20% more grain than rice without the gene," said Dr. Heuer.

"In our pot experiments," she added, "when we use soil that is really low in phosphorus, we see yield increases of 60% and more, suggesting it will be very effective in soils low in phosphorus such as in upland rice fields that are not irrigated and where farmers are often very poor."

The *PSTOL1* gene is also being tested in rice varieties for the more productive irrigated rice-growing areas and initial results show that the plants grow a better root system and have higher production, too. This means it could help farmers in these areas reduce their fertilizer use and expenses without compromising productivity.

The discovery also demonstrates the importance of conserving the genetic diversity of traditional crop varieties such as Kasalath. IRRI conserves more than 114,000 different types of rice in the International Rice Genebank.

New rice varieties with the enhanced capacity to take up phosphorus may be available within a few years to farmers.

IRRI Super Bags go commercial

CHRIS QUINTANA

"THE SUPER Bag prolongs the shelf life of stored grains," says Martin Gummert, IRRI postharvest expert.

An airtight, reusable plastic bag that protects stored rice from moisture, pests, and rats, and keeps rice seeds viable, is now available to Filipino farmers in selected retail stores.

IRRI Super Bags reduce losses incurred after harvest that usually stem from poor storage conditions—helping prevent physical postharvest losses that can be around 15%. On top of these losses, farmers also experience loss in quality.

Developed by IRRI's postharvest experts, in collaboration with GrainPro Inc., the IRRI Super Bag is meant for small-scale rice farmers to protect the viability and quality of rice stored in their homes.

The IRRI Super Bag is manufactured by GrainPro Inc. and is marketed as SuperGrainbag™. IRRI, through its national partnerships, has verified the benefits of the IRRI Super Bag with tens of thousands of farmers throughout Asia, but acknowledges the challenge of bringing the bags to millions of farmers in a commercial way.

Philippine farmer Manuel Luzentales Jr. has always wondered how to deal with rats and weevils gnawing their way into his paddy (unmilled rice) stored in ordinary sacks in his house.

The commercialization of IRRI Super Bags is a leading example of the public and private sector working together to get technologies to farmers.

After attending a seminar in a nearby town introducing the IRRI Super Bags to farmers in the Philippine Bicol region, he decided to test them.

"Before, a 7-month storage caused my rice grains to break from moisture and pest infestations," Mr. Luzentales recalls. "I tested the IRRI Super Bags on my harvest for the second planting season of 2010. After keeping my harvest in the IRRI Super Bags for 10 months, the seeds were 100% viable, and none were wasted."

Martin Gummert, head of the IRRI postharvest unit, said that partnerships with the public and private sector are critical to rolling out economically viable rice postharvest technologies and that IRRI Super Bags are a leading example of this in action.

Tom de Bruin, GrainPro's president and CEO, said that the bags will be available to farmers through a national retail network with close to 200 outlets.

Study supports nutritional value of Golden Rice

New research from Tufts University, published in the *American Journal of Clinical Nutrition*, concludes that the beta carotene produced by Golden Rice is as good as beta carotene in oil at providing vitamin A to children.

The World Health Organization (WHO) estimates that 190 million preschool children and 19 million pregnant women are vitamin A-deficient globally.

Beta carotene is converted by the human body to vitamin A as needed. It is commonly found in leafy green vegetables and fruits. Golden Rice also contains beta carotene, which other rice does not.

The study demonstrates that children, who are among those most vulnerable to vitamin A deficiency, could benefit from Golden Rice as a steady source of the nutrient.

Golden Rice is not currently available and is still being developed and evaluated by the International Rice Research Institute and others.

Breakthrough in resistance to Africa's "AIDS of rice"

AfricaRice scientists are improving the RYMV resistance of rice.

Farmers in Côte d'Ivoire have given their vote of support to rice with resistance to rice yellow mottle virus (RYMV)—locally called "the AIDS of rice."

RYMV is a disease of intensified irrigated rice production where high-yielding varieties have been introduced, and many irrigated varieties are extremely susceptible to it. It occurs only in Africa.

In 1995, the Africa Rice Center (AfricaRice) discovered that a variety from Mozambique (Gigante) was virtually immune to the disease.

Gigante's resistance was confirmed by AfricaRice's Dr. Marie-Noëlle Ndjiondjop against a whole spectrum of different types of RYMV from diverse locations in West Africa.

Working with national partners and the French international research institute IRD, Dr. Ndjiondjop and the AfricaRice team are using molecular breeding to improve the RYMV resistance of West African elite rice cultivars by incorporating Gigante's resistance gene into them.

They have already tested some of these potential rice varieties at multiple locations in the target African countries to confirm their resistance to diverse natural populations of RYMV. In Côte d'Ivoire, a farmer cooperative has named one RYMV-resistant rice being tested locally as "best rice variety."

RYMV-resistant rice varieties are expected to be released in key African countries in the near future.

A number of RYMV-resistant rice varieties are expected to be released in some of the countries in the near future.

AfricaRice and IRD have also discovered a second RYMV resistance gene. As an insurance policy against RYMV overcoming single-gene resistance, the AfricaRice breeding strategy is planning to "pyramid' two resistance genes in varieties for hot-spot areas.

Source: www.africarice.org

Renewed call for a rice futures market

The Asian Development Bank (ADB) has released the report Options for Addressing Price Risk and Price Volatility in Rice, which includes a renewed call for an international rice futures market.

According to the ADB, a regional rice index and commodities exchange could help calm world rice price fluctuations and ensure that farmers get a fair price for their rice.

The idea was initially proposed in 2010 in an Asia Society report backed by the International Rice Research Institute.

Source: www.adb.org

Brazil donates rice to Bangladesh

Brazil has donated 7,000 tons of rice to Bangladesh to help people cope with the adverse impacts of natural disasters and climate change.

The United Nations World Food Programme (WFP), in collaboration with the Bangladesh government, will distribute the rice.

The donation is Brazil's first contribution to WFP's food security programs in Bangladesh, which aim to build the resilience of food-insecure households against the effects of extreme natural hazards and climate change.

Source: www.thedailystar.net

TRAINING COURSES AT IRRI

Course title	Date	Venue	Target participants	Course fee (US$)
Rice: Postproduction to Market Training Course	22 October-2 November	IRRI, Philippines	Personnel involved in postproduction activities	2,500
Molecular Breeding Course	12-23 November	IRRI, Philippines	Scientists and researchers	1,700

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

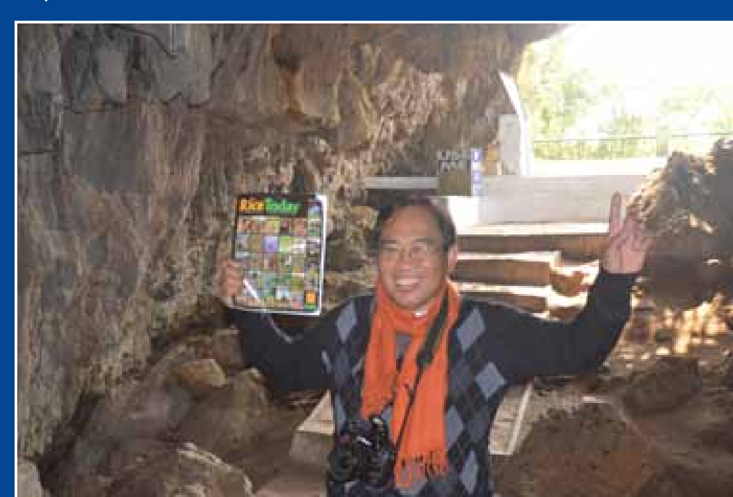
RiceToday around the world

IRRI KIDS in London. (*from left*) Maria Hettel, daughter of CPS head Gene Hettel; Tim and Darja Dobermann, son and daughter of IRRI Deputy Director General for Research Achim Dobermann; and Rory Kirk, son of former IRRI soil scientist Guy Kirk, display their copies of *Rice Today* while standing in front of a 200-year-old Victorian pub.

SUNNY SKIES in windy countryside. Holding a *Rice Today*, Moises John Reyes of DSM Nutritional Products Philippines Inc. relishes the windy site in Bangui, Ilocos Norte, where the first "wind farm" in Southeast Asia is located. This wind farm is composed of fifteen 23-story-high steel windmills that supply power to the northernmost region of the Philippines.

CLIMATE CHANGE ready in Vietnam. CLUES project staff members (*top, left to right*) Dr. Le Quang Tri, Dr. Nguyen Hieu Trung, Dr. Ngo Dang Phong, (*bottom, left to right*) Mr. Nguyen Thanh Giao, Ms. Dang Qun Giao, and Mr. Tran Thanh Ta pose with *Rice Today* as they find ways to help rice adapt to climate change in the Mekong Delta region.

DRY ICE. Donned in a winter outfit, IRRI senior associate scientist Joel Janiya enters the Mawsmai Cave in East Khasi Hills District, Meghalaya (a northeastern state in India). The cave is dry during winter but, during summer, water flows inside it. The area is close to Cherrapunjee, the wettest part of the world (average annual rainfall of 8,000–12,000 mm).



Dried to PERFECTION

by **Martin Gummert** and **Paterno Borlagdan**

Farmers can now obtain cheaper moisture testers

Farmers need not crack rice between their teeth to check whether the grains are dry enough for milling and storing because gauging the dryness of the grains no longer needs to be hit-and-miss. They can now be sure of the moisture content of their paddy because the International Rice Research Institute (IRRI) has found an affordable alternative.

After searching high and low and after many discussions with several electronics manufacturers in the Philippines, Cambodia, and India, IRRI scientists finally found an industry partner to produce and commercialize a low-cost moisture tester.

With the new IRRI moisture tester, farmers can benefit by making more-informed decisions on safely storing their harvest. And, they will have more negotiating power when they sell the paddy to traders.

Compared with previous versions, which were made by two small cottage industry workshops in Los Baños, Laguna, in the Philippines, the new device is equipped with improved electronics using state-of-the-art processes of the Manila-based Nanodevice Technologies, Inc. The tester now also comes with a warranty.

Moisture testing is important to farmers so they can check whether or not the paddy is dry enough, and can be stored safely. Also, when storing seeds in airtight storage systems, the IRRI moisture tester will help determine the seed moisture content before the storage container is sealed.

ISAGANI SERRANO (4)

This new device has three light-emitting diodes (LEDs) and a beeper to visualize the results: red, green, and yellow. Red indicates that the paddy is still too wet (above 14%) and needs to be dried, green means the paddy is dry enough for safe storage and at optimum moisture content for milling (12–14%), and yellow indicates the paddy is ready to be distributed as seed or is safe for seed storage (less than 12% moisture content).

Moisture content can be determined at a resolution of 1% within a range of 10–16% by observing the pattern of lights. The accuracy within this range is similar to that of a digital resistance-based moisture meter, which typically costs US$200–400. This affordable moisture tester is kept as simple as possible to keep the cost down, so it does not have a digital display.

It is always a challenge to leap from solid research results to commercially viable products because of the initial investment needed for adaptive R&D to develop something that can be mass-produced.

By pooling resources from the Asian Development Bank and the Irrigated Rice Research Consortium (IRRC) among other sources, IRRI was able to place an initial order of 350 units, which was sufficient for Nanodevice to be interested in conducting the R&D and to be able to replace expensive circuits imported from developed countries with cheaper components from China and to redesign the electronics to allow for a more automated production line.

Because of the small initial order volume and the development cost, the price tag is still relatively high. Hence, the 350 units are being distributed strategically to further develop the market for a larger order. Some will be sold through IRRI at a subsidized price of $55. Once orders reach 10,000 units, the price per unit may come down to $35. Further streamlining and improvements, such as investing in a mold for a custom housing, could lead to even lower prices.

Small orders of the moisture tester can be placed at the IRRI Riceworld Bookshop (riceworld bookstore@irri.org). For larger quantity orders, please contact Nanodevice Technologies, Inc., at tel. no. (63) 2 477-1379, telefax (63) 2 470-6485, or visit nanodeviceonline.com. For more information, email postharvest@irri.org.

1. The new IRRI moisture testers can help farmers come up with more-informed decisions on safe storage.
2. The low-cost device, shown here by Dr. Paterno Borlagdan, is now affordable with a warranty under the Manila-based Nanodevice Technologies, Inc.
3. Martin Gummert shows the three LEDs that visualize the results of moisture tests.
4. With the moisture meter, farmers can now be sure that the moisture content of their paddy is just right.

Mr. Gummert and Dr. Borlagdan are mechanization and postharvest experts at IRRI.

Why moisture content must be just right

Checking the moisture content of the grain is important in rice production because high moisture will create problems for farmers, especially during postharvest activities.

Heat buildup
The natural respiration of stored wet grain can generate excessive heat. Heat, combined with high humidity, provides excellent growth conditions for molds and insects and will thus contribute to grain deterioration.

Mold growth
Molds propagate diseases and may also release toxins into the grain. Although some mold-causing fungi may be present in the grain at harvest time, a safe moisture content can impede mold development. If the fungi are in the mycotoxin-producing family, rice can be unsafe for both human and animal consumption.

Insect infestation
Insect infestation is always a problem in storage facilities in tropical climates, even if the grain is completely dry. However, with less moisture content in the grain, insect problems will probably be fewer. A combination of proper drying procedures and storage practices, including storage hygiene, will keep insect infestation at acceptable levels.

Loss in seed germination
High moisture will also gradually reduce germination ability if the stored grain is destined to be used as seed.

Rice of less value
Heat buildup in stored rice due to a combination of insects, molds, and/or high humidity often leads to a musty odor, which will considerably reduce the grain's market value.

Heat buildup also results in a general yellowing of the grains. Discolored grain drastically reduces market value since whiteness is important to rice consumers.

Reduced head rice recovery
Fissuring or cracking of rice grains can occur when individual grains that were already dried reabsorb some moisture. This happens either when wet grain is mixed with dry grain or when dry grain is exposed to ambient air that has more moisture in it than the grain does. During milling, this fissuring reduces the recovery of head rice, which refers to the whole grains of milled rice that can be obtained from a given quantity of clean paddy.

On the other hand, if rice is overdried, that is, more water than necessary is removed, it will weigh less. Since rice is sold by weight, sellers' profits will be less. In addition, rice grains that are too dry are more brittle and more likely to break in the milling process, again reducing head rice recovery.

Source: Rice Knowledge Bank http://snipurl.com/grain-moisture

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FARMERS GOT TALENT!

by **Trina Leah Mendoza**

Cool and collected, *Pak*[1] Darwis, a 56-year-old Indonesian farmer from Bone District, South Sulawesi, waits for his signal. When he hears "action!," he begins talking animatedly in his local dialect. He stresses his words carefully; his eyes are expressive. Facing the video camera, he shows how to make a water tube—a tool that monitors water levels in the rice field for alternate wetting and drying (AWD), a water-saving method developed by the International Rice Research Institute (IRRI). The small audience watching the shoot is silent, mesmerized, and in awe of his confidence and knowledge.

Pak Darwis is one of the farmers who have adopted AWD and other rice-growing technologies introduced by IRRI's Irrigated Rice Research Consortium (IRRC). The 2008-11 project, funded by the Australian Centre for International Agricultural Research, increased farmer-adopters' incomes by an average of US$207 per season per hectare in South and Southeast Sulawesi.

Seeing green

In January 2011, the IRRC learned about participatory videos being produced by Digital Green, an organization based in India, which aims to raise the livelihoods of smallholder farmers through targeted production and dissemination of agricultural information via participatory video and mediated instruction. "Participatory video is a powerful tool because it is both engaging and expressive," says Rikin Gandhi, Digital Green chief executive officer. "We use information and communication technology to amplify the effectiveness of agricultural extension systems around the world."

Using their approach, short learning videos that capture new or improved agricultural technologies and practices are created by farmers, for farmers. These videos, available on the Digital Green Web site (www.digitalgreen.org), are shared among similar communities through facilitated discussion.

To capture farmers' success stories on video, the IRRC tested this approach in July 2011. Armed with camcorders and knowledge of Digital Green's standard operating procedures, IRRC scientist Donna Casimero, communication specialist Rona Rojas, and I flew to Konawe District, Southeast Sulawesi, to take on the challenge.

Four farmers who have adopted direct-seeding technology developed the storyboard. This was done with guidance from Dr. Casimero and staff from the Assessment Institute for Agricultural Technology (AIAT) of Southeast Sulawesi.

The storyboard includes why farmers chose direct seeding using a drum seeder; how they prepare seeds, manage weeds, and use the drum seeder; and how their lives have changed after direct seeding. These storyboards do not contain fabricated dialogue and are used to accurately guide farmers in discussing their views.

Pak Andi Caco and Tahir were a bit nervous at the start of the shoot, but, after some time in front of the camera, they became comfortable and confident in sharing their experiences and benefits from the technologies. Most, if not all, interviews were done in one take. *Pak* Caco showed the original IRRI drum seeder with six drums and explained that he altered it by removing two drums so that it would be lighter and easier to pull in their field. The next day, the farmers demonstrated direct seeding, land leveling, weed management, and herbicide spraying while Rona and I captured these activities on camera.

"Now that we are direct seeding, we do not need to hire many people to transplant or spend a lot on transplanting," shares Tahir. "Now, we need only one person to directly seed 1 hectare."

"I used the income from the paddy fields and rice mill that I bought to send my children to school," adds *Pak* Caco. "Our life is much better than when we first came to this place."

Gaining reviews

In January 2012, Dr. Casimero and I returned to Southeast Sulawesi with the draft video to get farmers' feedback. About 20 farmers, including some women, enjoyed it and were able to remember its messages afterward. They discussed it among themselves every so often and were delighted to see their peers on screen. To improve the video, they suggested including graphics showing the economic benefits of direct seeding.

PAK DARWIS, a farmer from Bone, South Sulawesi, demonstrates how to make a field water tube to monitor water levels in the field.

DONNA CASIMERO

FARMERS FROM Bone, South Sulawesi, watch a video on direct seeding using a drum seeder. The video was made by farmers in Southeast Sulawesi.

TRINA MENDOZA

The 13-minute video, arguably long by industry standards, was still too short for them. They suggested other video topics leading to postharvest. They are eager for farmers in other areas to see their video.

The IRRC team did just that and traveled 5 hours from Makassar City over mountains and fields to show the video to farmers in Bone, South Sulawesi. Although farmers in that area did not practice direct seeding, they enjoyed the video and found other farmers telling their stories convincingly.

Take two

Inspired by the positive feedback on the direct-seeding video, the IRRC team developed two more videos on site-specific nutrient management in Southeast Sulawesi and AWD in South Sulawesi.

This time, farmers Mulyadi and Mappa were more nervous in front of the camera, so the AIAT facilitators had to rephrase their questions and help them once in a while to relax and think of the interview as a conversation with friends.

As expected, Mulyadi was more at ease in the field when he described and demonstrated his fertilizer applications.

"After attending the farmers' field school at IRRI in collaboration with AIAT, we now practice appropriate and balanced fertilization on our farm," explains Mulyadi. His yield increased and his family was able to move out of its rented house and build a small house.

Mappa was also able to build a small house with his increased yield, and was able to support his wife's pilgrimage to the Holy Land.

Over in Bone, South Sulawesi, *Pak* Darwis and Beddu Rahman were in charge of the show. It was easy for them to create the storyboard and identify the activities and topics they wanted to include in the video. They needed little guidance. During the shoot, they were confident, relaxed, and spontaneous in front of the camera.

"This method is very useful; production has increased 20–30% because the farm is not too flooded," says *Pak* Darwis.

"The advantages of applying AWD include efficient water use, an increase in cultivation area, and synchronous planting during the dry season," adds *Pak* Beddu Rahman, "The farmers are thankful because of this method."

Handing over the reins

Dr. Casimero believes that the AIAT staff and farmers were empowered as they gained skills and confidence in storyboarding, interviewing, and talking in front of the camera. "Simple techniques in video shooting and editing can be taught to them, so that they can sustain this approach and truly have impact," she says.

Bas Bouman, a water scientist and new director of the Global Rice Science Partnership (GRiSP), sums up the Digital Green experience perfectly: "In our 'regular' video productions, we are used to being fully in charge, from script to images, down to word-for-word text; we control the message, content, and everything. With the Digital Green approach, the farmers are actually in control! They highlight benefits and pros and cons in their own way, using their own experience and their own particular settings."

See the participatory videos described here in a YouTube playlist at http://snipurl.com/farmer-videos

[1] *Pak* is short for an Indonesian word *Bapak*, which means father or mister.

Eyes on the PRIZE

by **Ma. Lizbeth Baroña-Edra**

When today's farmers look at what's in it for them, money-wise, they face decisions on what technology to adopt and what farming practices to pursue, but the task is not as easy as it used to be. Higher yields are no longer the only factor that leads to higher profits.

Rice farmers all over the world are using new and improved technologies. And, to some degree, these technologies have helped keep many of the world's poor from being pushed further down the road to poverty.

An example is IR8, the media-dubbed "miracle rice," developed by the International Rice Research Institute (IRRI) in the mid-1960s (see *Breeding history* on pages 34-38 of *Rice Today*, Vol. 5, No. 4). Average rice yields before IR8 was available to farmers were 2 tons per hectare. The arrival of IR8, which produced yields that could be 9.5 to 10.5 tons per hectare, changed the trajectory of humanity's poor, especially in Asia. This pivotal rice variety has found a deserved niche in the annals of humanity's efforts to feed itself as part of the Green Revolution.

"In the early years following the Green Revolution, we did not have to pay much attention to profit," says Kei Kajisa, IRRI senior scientist and socioeconomist from the International Rice Research Institute (IRRI). "Yield-maximizing recommendations matched farmers' profit maximization objectives, too. Today, with different factors affecting rice-farming practices, high yield does not necessarily result in high profit. Sometimes, whether farmers make a profit or not is tied to their management or the choices that they make."

As time marches on, it has become clear that there is no shortage of lessons to be learned and, consequently, there are opportunities to grab and exploit. Achim Dobermann, IRRI's deputy director general for research, thinks that if a given technology helps farmers to garner robust profits, it will spread quickly. "But, we have to understand that farmers make decisions on how to maximize profit and minimize risk," says Dr. Dobermann, "and this decision-making happens for a whole sequence of crop management operations. These decisions can lead to incremental gains–or losses–as the success of a single technology may also depend on other decisions farmers make."

Today's weighing game

Dr. Kajisa and his team have been studying farming communities in the Philippines, China, and India, as well as getting insights and trends from four decades' worth of grass-roots socioeconomic information.

"Now, some farmers choose field practices to maximize their profit, but these practices do not necessarily result in increasing their yield," says Dr. Kajisa. "When IRRI was established in 1960, there were adequate resources (such as water and labor), but technology was lacking. Today, we see a reversal in that many technologies are available, but water and labor are becoming alarmingly scarcer. In addition, there has been a sudden urgency to develop modern rice varieties that can cope with climate change."

Dr. Kajisa points out that when water becomes scarce in a farming community, it is important for members of that community to work together to maintain their water source and to develop a water rotation scheme among themselves. "There is also potential to use volumetric pricing for efficient water use within a community," he says. "With this, farmers will pay less when using less water and pay more for increased water use, which should be offset by a higher crop yield."

On the labor-scarcity front, Dr. Kajisa's study found a new developing trend in farmers' practices—the *casualization* of labor. There is now a general decline in attached or permanent labor and an increase in outsourcing or nonpersonalized labor arrangements. This is becoming common in many parts of South and Southeast Asia.

"Casualization is problematic because the rice crop requires rigorous attention," says Dr. Kajisa. "Some farming practices are better implemented when farmers are present themselves or they have trusted permanent laborers onsite who will conduct activities honestly."

IRRI (2)

DIRECT SEEDING is seen by farmers as one way to save on labor cost.

Ultimately, most farmers will find ways to cope with water and labor scarcities to maximize their profits, but yields might suffer as a result. As Dr. Kajisa observed in China, one location had a successful community-managed water source but high labor costs due to scarcity. So, to save money, the farmers decided to broadcast or direct-seed instead of transplanting seedlings. Because of this decision, yields decreased, but, in the end, the labor savings still allowed the farmers to turn a profit.

In the Philippines, farmers are also inclined to direct-seed their crop. "They decide to do this, not because it is a proven practice resulting in high yield, but because it saves on labor costs," says Piedad Moya, IRRI socioeconomist. "Transplanting seedlings would force them to hire more laborers to do the job. With direct seeding, they can sow the seed themselves in 1 day." Ms. Moya, a member of Dr. Kajisa's team, is also involved in IRRI's decades-old household survey designed to gather grass-roots information on farmers from all over Asia.

For farmers, not scientists

The findings of Dr. Kajisa's team draw attention to what drives a farming community to come together to manage a scarce resource such as water or how to cope with rising labor costs. These decisions are very much shaped by the fact that everyone is no stranger to profit. This is logical because farmers' take-home income translates into having adequate food, education, and medical security for their families.

These findings have given researchers and extension workers something to think about.

"My own rule-of-thumb has always been that most farmers will be interested in a new technology only if it is easy to understand and apply—and if it increases their profit by at least US$50 per hectare," says Dr. Dobermann. "I have observed that many technologies may sound good in theory or do well in a carefully designed research trial, but they don't necessarily meet farmers' expectations in the field."

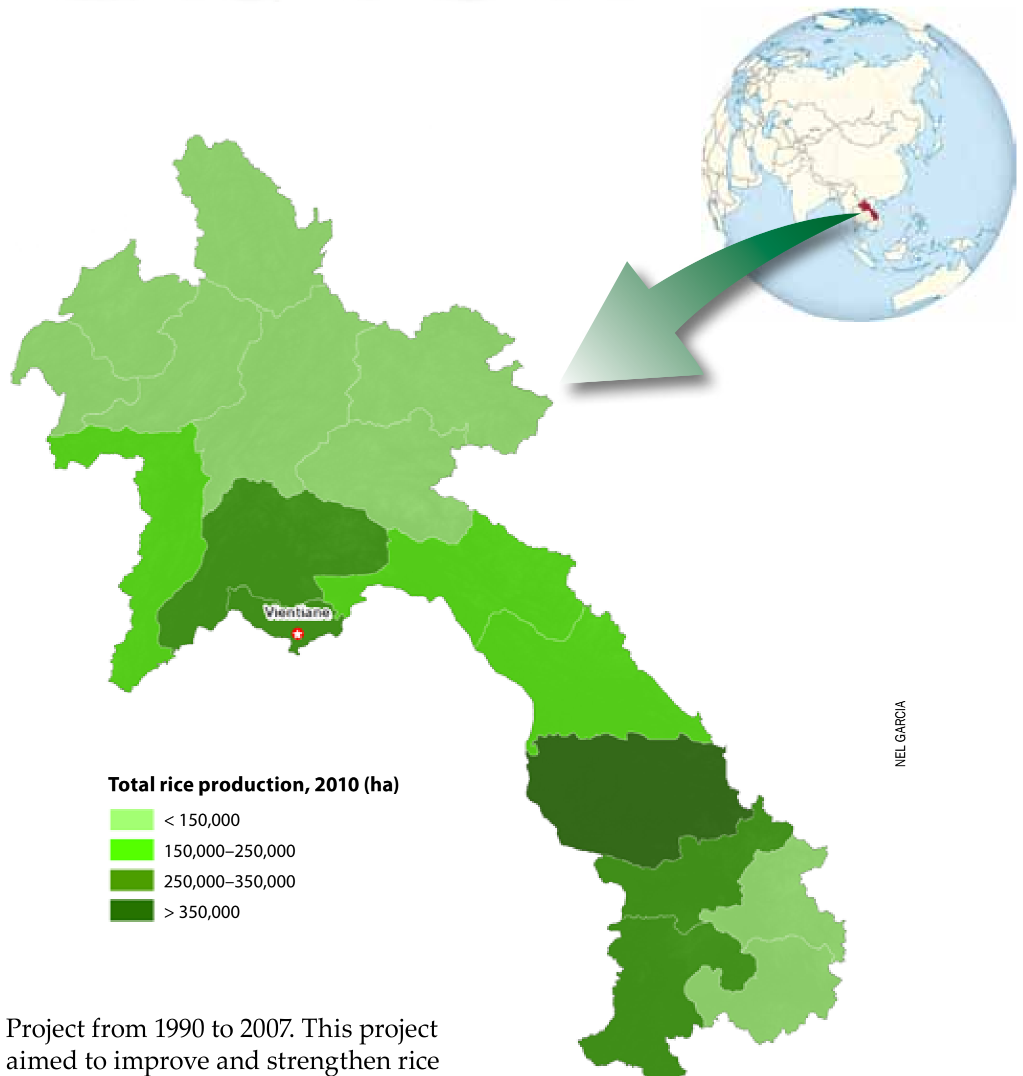
IRRI researchers are not only breeding new rice varieties that are high-yielding, are stress-tolerant, and have good grain quality, but they are also developing and evaluating crop management technologies that are environmentally sustainable and cost-reducing.

"Farmers are always keen to look for better ways to grow their crop, as long as they have access to new information," explains Dr. Dobermann. "One of IRRI's roles is to get this information to them as rapidly as possible. We need to use the available information channels and forge private and public partnerships to make sure that what we do is driven by the needs of farmers, not the needs of scientists."

IRRI's research chief thinks that the Institute needs to focus more and more on finding solutions that involve truly integrated crop and cropping systems management under real-world field conditions.

COUNTRY HIGHLIGHT:

IRRI in Lao PDR



Rice production is an important livelihood of around 724,000 farmers in Lao PDR, whose rice sector is rapidly transforming from pure subsistence to more commercial production. Rice farmers who sell their produce increased from 6% in 1998-99 to 30% in 2010-11.[1]

Generally, rice is produced by small farm households with an average farm size of less than 2 hectares. Although rice farming in Lao PDR is small-scale, its average size of rice holdings has increased over the last 12 years. Almost 90% of the rice area in Lao PDR is rainfed, predominantly in the lowlands.[2]

Rice remains the staple food for Lao PDR and glutinous rice is the most popular type of rice—more than 90% of the rice produced is glutinous. Lao PDR also appears to be the center of biodiversity for glutinous rice and has one of the highest concentrations of biodiversity of rice in the world.

Lao PDR and IRRI

Lao PDR-IRRI collaboration began in the late 1960s. This continued in the 1970s with the testing of improved rice breeding material from IRRI's rice breeding and selection work in Lao PDR. Systematic multilocation yield trials followed by the multiplication and dissemination of several IRRI lines and varieties to farmers took place in 1973.

The first memorandum of understanding between Lao PDR and IRRI was signed in 1987. Heightened collaborative work began when the Swiss Agency for Development and Cooperation (SDC) supported the Lao PDR-IRRI Research and Training Project from 1990 to 2007. This project aimed to improve and strengthen rice research capacity within the country.

On 12 January 2007, Dr. Sitaheng Rasphone, Lao PDR minister for agriculture and forestry, and Dr. Robert Zeigler, IRRI director general, signed a memorandum of understanding to establish a regional hub in Lao PDR; thus, the IRRI-Greater Mekong Subregion office in Lao PDR was formally opened. The office has since become the IRRI-Lao PDR office.

To intensify Lao PDR-IRRI collaboration, foster new partnerships, and strengthen current ones, IRRI held a consultation workshop on 26 October 2011 in Vientiane, with government researchers, scientists, extension workers, policymakers, and donors in the rice sector. The workshop defined areas of collaboration to start and strengthen, including the improvement of seed production practices and the testing and establishment of public-private partnership models for disseminating agricultural technologies.

IRRI has had at least 13 staff members posted to Lao PDR. Two internationally recruited staff are presently posted there: Dr. Benjamin Samson, agronomist and representative to Lao PDR, and Dr. Rubenito Lampayan, water management specialist.

On 11 May 2012, his Excellency Thongsing Thammavong, prime minister of Lao PDR, visited IRRI headquarters in the Philippines.

IRRI's work in Lao PDR is supported by the International Fund for Agricultural Development, SDC, the Bill & Melinda Gates Foundation, the Australian Centre for International Agricultural Research, the government of Japan, and Germany's Federal Ministry for Economic Cooperation and Development.

Current research and development activities with Lao PDR

Helping farmers in uplands. Through the Consortium for Unfavorable Rice Environments, IRRI is helping farmers in Lao PDR's northern mountain region upgrade their agricultural practices and find varieties that suit their environment and minimize environmental impacts on this fragile environment.

Helping farmers in irrigated areas. As part of the Irrigated Rice Research Consortium, IRRI is helping farmers in irrigated areas adopt beneficial postproduction processing and water management technologies.

Helping farmers in southern Lao PDR. For farmers in rainfed regions in southern Lao PDR, IRRI is developing improved soil, nutrient, water, and crop management technologies to improve the livelihoods of rural people.

Breeding better rice varieties. IRRI is developing varieties with beneficial traits, such as drought and submergence tolerance, that are important for Lao farmers and that suit different growing regions and conditions.

Lao PDR: fast facts (2010)

Population:	6.2 million
Total rice production:	2.7 million tons
Average rice yield:	3.47 tons per hectare
Area planted to rice:	870,000 hectares
Average annual rice consumption per person:	165 kg (2009)

Source: FAO data on World Rice Statistics

Coping with climate change. IRRI is collaborating with Lao PDR researchers to test seasonal weather forecasting, adapt crop management systems, and produce decision support systems.

These information resources and tools will help farmers cope with climate change.

Better grain quality and value. Under the Grain Quality Improvement Network, IRRI is enhancing the aroma of Lao PDR-grown rice to help improve its quality, value, and export appeal.

Sharing knowledge. IRRI is helping to further develop the Lao PDR Rice Knowledge Bank—an online repository of effective and practical best management practices for rice production.

Key achievements in Lao PDR

Conserved Lao PDR's rice genetic diversity. Lao PDR has deposited more than 15,000 types of rice in IRRI's International Rice Genebank, making the country the second-largest contributor. In turn, IRRI has dispatched 750 rice samples to Lao PDR for breeding and other research, and restored more than 11,000 types.

Improved rice production. Total rice production in Lao PDR increased from 1.5 million tons in 1990 to more than 2 million tons in 1999, at which time the country achieved rice self-sufficiency, while the SDC-supported Lao PDR-IRRI project was under way. Current rice production exceeds 3 million tons.

Modern rice varieties adopted. By 2004, modern rice varieties had been adopted in Lao PDR by 80% of the farming households and on 69% of the land planted to rice. Rice varieties developed with IRRI accounted for 51% of the planted modern varieties and included TDK1 and 5, and PNG 1 and 2. A 2008 study showed that 87% and 67% of farmers, inside and outside, respectively, of the major rice-growing plains of Lao PDR grew improved glutinous rice varieties.

Improved crop management practices. Researchers developed and adapted a seven-step best management practice manual and poster for rainfed lowland rice, which covers variety selection, good seed production, land preparation, crop and field management, harvesting, and storage.

Supported rice science in Lao PDR. IRRI has contributed to a fully functional national rice research system in Lao PDR, hosted 60 Lao scholars, and trained 179 people from Lao PDR in short courses. Currently, Mr. Phetmanyseng Zangsayasane from Laos is completing his PhD with IRRI and Khon Kaen University.

IN LAO PDR, rice production is an important livelihood of 724,000 farmers.

IRRI

[1] World Bank, Food and Agriculture Organization, and IRRI. 2012. Laos Rice Policy Study. Rome (Italy): World Bank, 115 p.
[2] *Ibid.*

Dante D. Hipolito©

THE HARVEST. This is a reproduction of an oil-on-canvas painting by Filipino artist Dante D. Hipolito© (hipolitostudio@yahoo.com). Mr. Hipolito's work is also featured in our special insert wall calendar for 2013.

THE FIRST LADY OF RICE

by **Alaric Francis Santiaguel**

Lady beetles are farmers' best friends because they eat pests that destroy rice

CHRIS QUINTANA

Don't let the lady beetle's adorable appearance fool you. These beetles, both adults and their larvae, are voracious predators and play an important role in controlling rice pests, including leafhoppers and planthoppers.

Lady beetles, also known as "ladybirds" or "ladybugs," are one of the rare insects that do not seem to have the "ick-factor." These delightful beetles (Coccinellidae) are a favorite of children and have been turned into toys, trinkets, and motifs. They populate art, literature, TV, and films. One can even find lady beetle-inspired confections.

In living colors

Why they have become celebrities of the insect world is easy to see. Coccinellids, with more than 5,000 known species, can be found in every corner of the planet except the North and South Poles. But, regardless of where they live, the entire family shares a common trait—an outrageous "fashion" sense.

Depending on the species, lady beetles come in shimmering red, yellow, brown, black, or gold. Many have from 2 to more than 22 bold black spots. Black ladybirds may have orange or yellow spots that just scream for attention. Still others, instead of spots, carry what appears to be tiny brush strokes painted frivolously on their oval, domed backs or hardened forewings called elytra.

Distasteful divas

The bright colors of the lady beetles are not an indication of the cheerful demeanor that has been attributed to them. The loud hues are actually warning colors (aposematism) designed to ward off would-be predators. Lady beetles secrete a bad-tasting fluid from the joints in their legs and their colors "advertise" that they should be left alone.

However, their appearance is not the only factor that makes them a great species to have around. These beetles are voracious predatory insects that feed on mites, mealybugs, leafhoppers, stem borers, thrips, scale insects, and other small soft-bodied insects as well as eggs and larvae or nymphs of these insects. The average adult lady beetle, during its lifespan of about a year, can consume more than 5,000 aphids.

Farmers' jewels

"Lady beetles are good predators of planthoppers, one of the most serious pests of rice," said Dr. K.L. Heong, an insect ecologist at the International Rice Research Institute (IRRI). "Farmers should welcome their presence."

Born to kill

Lady beetles are useful long before they become adults. A single beetle can produce as many as several dozen eggs on leaves where their larvae are likely to find sources of food upon hatching. Although their larvae look nothing like the attractive adults (in fact, they are quite ugly at this stage), they are just as useful.

"The larvae are voracious predators, and they feed on nymphs of planthoppers and the larvae of other pests found on rice," said Dr. Heong.

A single lady beetle larva will eat as many as 300 aphids before entering the pupa state. If a single female lady beetle can lay more than 2,000 eggs in her lifetime, do the math and the number of insect pests both larvae and adults consume is staggering and a great help to farmers.

SYLVIA VILLAREAL

The right way to treat a lady

Legend has it that English Catholic farmers in the Middle Ages believed that lady beetles were sent by the Virgin Mary, in answer to their prayers for help, to eat the aphids that were destroying their crops. Hence, they were called "Our Lady's Beetle."

Today, IRRI scientists are encouraging farmers to attract lady beetles, and other predatory insects, to their fields by creating a habitat where they can live and multiply. Lady beetles typically live in dense foliage such as hedges and trees, although others may prefer forests, fields, grasslands, or locations near waterways and wetlands.

For example, in the ecological engineering field at IRRI, these species are observed to feed on the nectar of flowering plants. Planting flowering plants on the bunds of rice fields provides sources of food and shelter for them.

The method known as ecological engineering restores and reinforces the diversity of natural enemies of rice pests to reduce the vulnerability of crops to pest invasions. Reducing the use of pesticides is a big part of the strategy (see *Letting nature manage its battles* on pages 32-34 of *Rice Today Vol. 10, No. 4*). At the same time, it also restores floral biodiversity. Minimizing disruptive factors such as withholding early-season insecticide sprays is a big part of the strategy. Insecticides should be used only as a last resort.

Where rice pests and diseases do the most damage

by **Adam Sparks, Andrew Nelson,** and **Nancy Castilla**

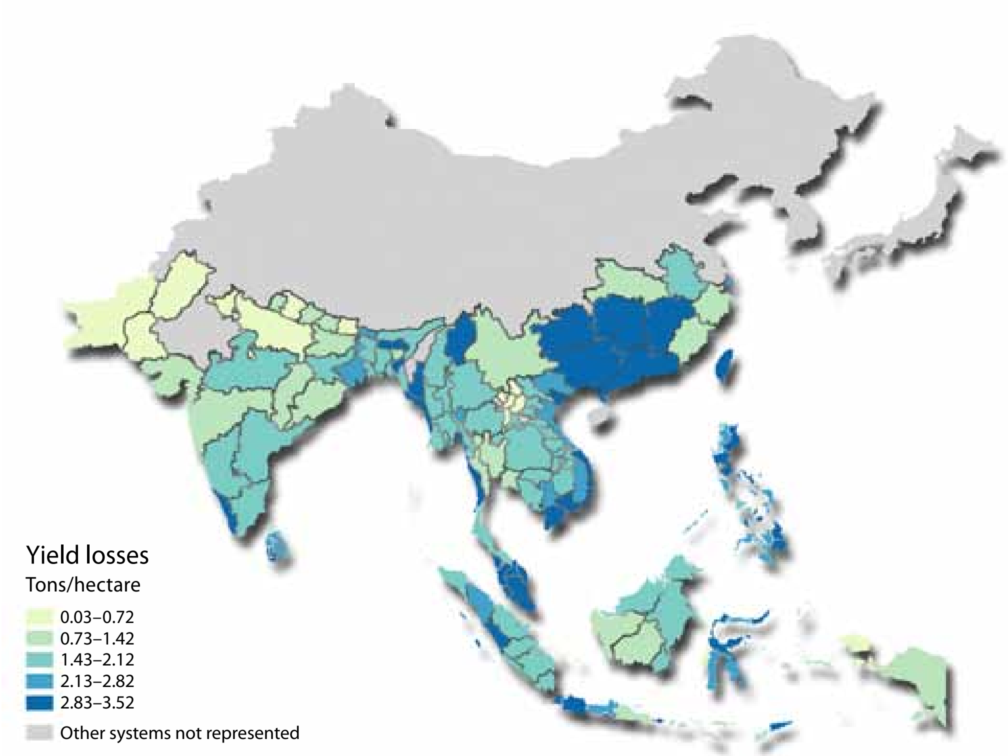


Fig. 1. Average predicted annual yield losses caused by pests and diseases in South and Southeast Asia.

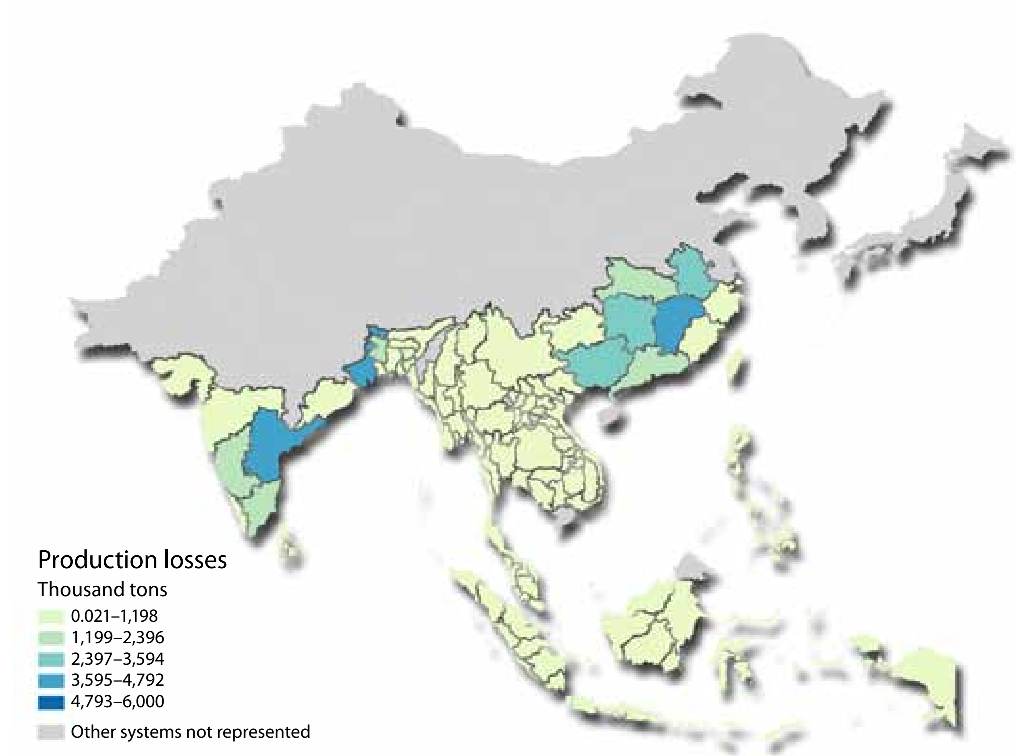


Fig. 2. Total predicted rice production losses for intensive irrigated double- or triple-rice systems.

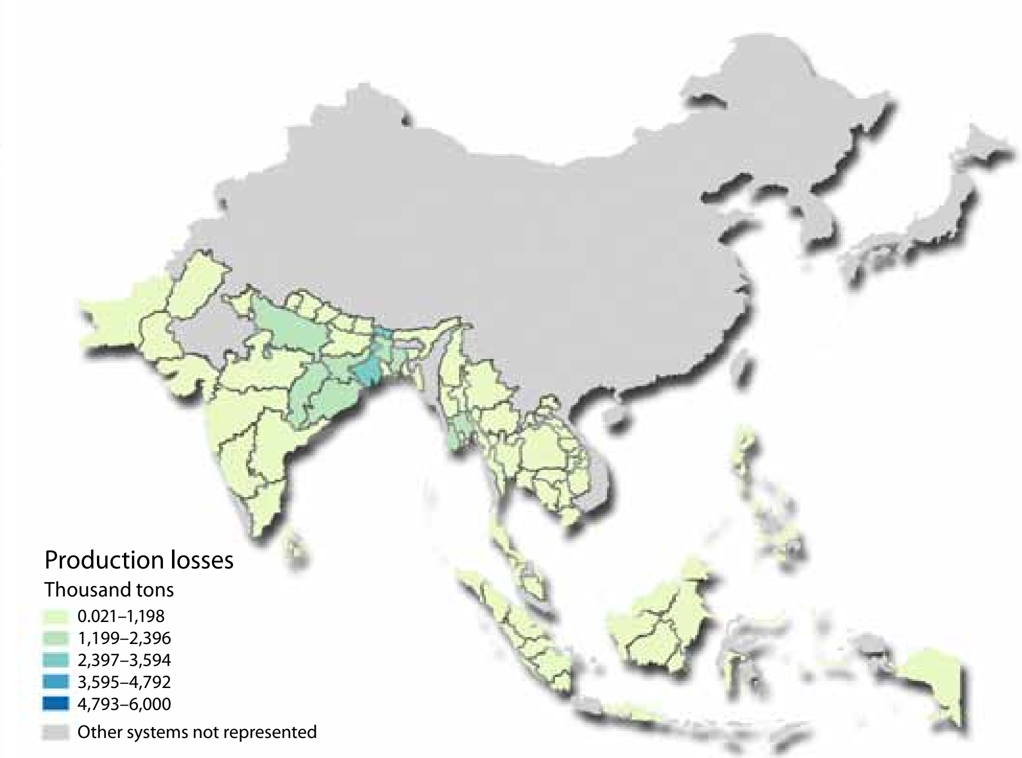


Fig. 3. Total predicted rice production losses for rainfed rice followed by a rainfed nonrice crop.

In a study conducted by the International Rice Research Institute (IRRI), it was found that, on average, farmers lose 37% of their rice yield to pests and diseases, and that these losses can range between 24% and 41% depending on the production situation.[1]

We have a good idea of what pests and diseases affect rice, but we do not always have a clear picture of where individual or groups of pests and diseases occur and how much effect they have on rice yield. One approach that can be used to gain insight into this is to develop a yield loss model based on a wide range of pest and disease injuries and corresponding yield losses under different rice production situations across Asia.

A production situation is a combination of physical and socioeconomic factors that influence agricultural production. Models like this are instructive tools that simplify real-world processes, but still provide useful information about the outcome of these processes.

The next step is to determine where these production situations occur and how many hectares they cover, and then use the model to estimate the loss in yield and production for each region of rice-growing Asia in which these situations are thought to occur. Finally, these pieces of information can be combined and visualized in a geographic information system (GIS) to extrapolate the results of the yield loss model and generate maps that provide a broad overview of possible pest and disease occurrences and the resulting yield losses across large geographic areas.

Here, we used RICEPEST,[2] a rice yield loss model that simulates yield losses due to sheath blight, brown spot, sheath rot, bacterial leaf blight, brown planthopper, defoliating insects, deadhearts and whiteheads caused by stem borer, and weeds. Although not exhaustive, this list includes the most important pests and diseases that afflict rice in tropical Asia.

[1] Savary S, Willocquet L, Elazegui FA, Castilla NP, Teng PS. 2000. Rice pest constraints in tropical Asia: Quantification of yield losses due to rice pests in a range of production situations. Plant Disease 84:357-369.

[2] Willocquet L, Elazegui FA, Castilla N, Fernandez L, Fischer KS, Peng S, Teng PS, et al. 2004. Research priorities for rice pest management in tropical Asia: A simulation analysis of yield losses and management efficiencies. Phytopathology 94:672-682.

Next, we looked at the losses that could be expected in two of the most common rice agroecologies of tropical Asia: an intensive irrigated monoculture system in rice is cropped twice or three times a year, and a rainfed system in which rice is cultivated once and is followed by another nonrice crop in the same year.

We estimated the area under both of these systems for different Asian regions by following the same methodology used in the well-known Huke and Huke rice maps of Asia, that is, a combination of expert opinion and recently published agricultural statistics. Using GIS, yield loss estimates were combined with estimates of the area that these agroecologies occupy in each region (state or province for example) in countries across Asia. Thus, we were able to generate maps of possible yield loss estimates (Fig. 1) and possible total paddy production losses per region (Figs. 2 and 3).

In general, the greatest predicted average yield losses take place in regions where double- or triple-rice irrigated systems dominate (Fig. 1). This is because there are at least two seasons of rice in these regions annually and these losses are summed in Figures 1 and 2. On the other hand, the rainfed rice and other crop systems have only one season of rice annually (Fig. 3).

In each of these systems, weeds and sheath blight caused the most losses in the double/triple irrigated system, while weeds and, to a lesser extent, sheath blight, brown spot, sheath rot, and whiteheads caused losses in the rainfed rice and other crop system.

These maps are just the first step as we find new ways to obtain more information about insect pests, diseases, weeds and the amount of yield losses they cause in rice plants, based on weather data, production situations, crop health surveys of farmers' fields, and results of field experiments.

Maps such as these are useful tools that show where researchers should focus their efforts for pest and disease management and help understand which pests and diseases should be managed in different regions. Also, these maps can be used to determine where specific pest and disease management strategies have the greatest impact in reducing yield losses, formulate policy-making decisions, and guide further scientific research, thus helping IRRI and partners achieve larger goals.

Dr. Sparks is a postdoctoral fellow, Dr. Nelson is a geographer, and head of the GIS lab, and Dr. Castilla is a senior associate scientist at IRRI.

From rags to riches with rice farming

by **Joyce S. Luis, Thelma Paris,** and **Teodora Malabanan**

A couple from humble beginnings earned a million pesos worth of assets from planting rice

JOYCE LUIS

In 1989, Marcelino Castañeda and his wife, Leticia, used their savings from rice farming to buy a bull, which they sold after a year. From their earnings, they bought two calves, a male and a female, for breeding. At that time, fodder for livestock and grazing fields was still abundant. Gradually, they were able to increase their herd to 20 cattle. One of the major assets they purchased from the sales of their cattle was a 1,428-square-meter residential lot in a village.

Transplanting crew

For 15 years now, since she started rice farming in Guimba, Nueva Ecija, on the island of Luzon, Philippines, Leticia has been leading a group of 15 women and 5 men farmers in off-farm transplanting. For the first 2 years, they engaged in *suyuan*, an exchange labor system, in which groups of farmers agree to work on each other's farm by turns for free.

During the 1999 wet season, the group agreed to try a contract system of transplanting. In this system, the group of farmers is hired as "transplanters" by both members and nonmembers. Farmers would approach the group leader to hire services during the transplanting season. The group is paid PhP2,300 ($55) per hectare, which is divided among the group members; an additional PhP100 ($2.40) is given to the group leader for each hectare transplanted.

"We work all day long and we transfer from one field to another," Leticia said. "Aside from the cash benefits, I gained the trust and respect of the members, which I repay by doing my part in looking for other farmers who need our services.

"I also provide the members' cash advance—usually a month before the transplanting job," she narrated. "They use this cash to pay for their children's tuition fees. Since we are paid immediately after we transplant, and sometimes even in advance, the members are able to pay back the money they borrow."

Putting eggs in other baskets

In 2006, the couple also started cultivating onions on their 3.25-hectare farm. They were lucky that year because they earned about PhP80,000 ($1,920), some of which they used to buy a motorcycle. Later on, they added a sidecar to transform it into a tricycle for hire—an additional source of income for the family. Because of a good harvest and a good price for onions, they were able to earn more profits, which they used to buy a power thresher.

Risk management

Unfortunately, bad weather in 2007 caused losses in their onion production. "I realized that onions are sensitive to changes in the weather during the summer months," Leticia recounted. "Since then, we stopped planting onions.

"Although rice production is less profitable than onion production, rice gives us food security throughout the year," she added.

In 2008, they went back to planting rice during the wet and dry seasons.

Flowing with change

Intially, they used a diesel-fueled water pump to supplement the primary source of irrigation. But, in 2009, when irrigation facilities were installed in their village, irrigation water from the canal reached their fields. Irrigation and the assurance of a continual water supply brought about a lot of changes not only for the members but also for the entire farming community.

"On our farm and in neighboring villages, transplanting is done simultaneously because of this irrigation," she said. "Farmers grow two crops of rice, thus increasing the demand for the transplanting crew during the dry season.

"With the irrigation canal in place, we mortgaged 2 hectares of rice land worth P110,000 ($2,644) in 2010, and our son volunteered to cultivate it," Leticia continued. "In 2011, we mortgaged another 1-hectare farm worth PhP50,000 ($1,200)."

Proof of profitability

"Now, my husband, my children, and I are engaged in rice farming and the total rice area that our family is working on is 7 hectares," she disclosed. "Although my children live in separate houses, we all help one another.

"Aside from our farm income (sales from rice and livestock), our daughter's remittances from Manila help us buy farm inputs at the right time," she said, accounting for other sources of their income. "As a wife and mother, I manage our budget quite well. I save and allot budget for farm inputs and for the mortgage of our lands."

Good farm management, hard work, and available capital to buy farm inputs are necessary for profitable farming, she indicated.

"Most of all, we keep on farming because it is our food security for the whole year," said Leticia. "My husband and I believe that all our children will not abandon rice farming because it has given us a good life. We believe that there is hope for a better life through rice farming."

Ms. Luis is an associate scientist, Dr. Paris is a gender specialist, and Ms. Malabanan is a statistician in IRRI's Social Sciences Division.

Training Africa's national partners in rice biotechnology

Giving an EDGE to young African researchers

by **Savitri Mohapatra**

It was a proud moment for three PhD students from West Africa participating in the graduation ceremony at the University of KwaZulu-Natal, Pietermaritzburg, South Africa. They had just taken a decisive step forward in fulfilling their dream of becoming biotechnology specialists.

Mounirou El-Hassimi Sow of Niger, Honoré Kam of Burkina Faso, and Kouadio Nasser Yao of Côte d'Ivoire all had worked in the biotechnology laboratory of the Africa Rice Center (AfricaRice) in Cotonou, Benin, under the supervision of Marie-Noelle Ndjiondjop. Their sense of pride was shared by Gustave Djedatin from Benin, who successfully defended his PhD thesis in front of an international panel of scientists at the University of Abomey-Calavi in Benin.

"These students have each made major contributions to global knowledge of rice in Africa," declared Prof. Mark Laing, director, African Centre for Crop Improvement at the University of KwaZulu-Natal. "They are also keen to apply their newly acquired skills in their respective countries."

Their doctoral research was supported through a USAID-funded AfricaRice project on the application of marker-assisted selection (MAS). This aims to find solutions to rice yellow mottle virus (RYMV) infection (see the news report on page 8) and two other devastating rice biotic stresses, African rice gall midge (AfRGM) and bacterial leaf blight (BLB).

As part of their studies, the students traveled thousands of kilometers by motorcycle and boat to interview rice farmers and collect their local varieties. Mounirou, for instance, collected about 270 local rice varieties, many of which face extinction. These varieties were then characterized through field trials and DNA profiles for use as parental material in breeding for RYMV resistance.

DR. NDJIONDJOP of AfricaRice, second from left, is helping national partners to use molecular breeding techniques to speed up the process of developing disease- and pest-resistant rice varieties.

The making of a work force

In rice breeding, the efficiency of MAS to transfer major rice genes is now widely recognized as it offers rice breeders a better opportunity to develop varieties that are resistant to diseases and pests and tolerant of abiotic stresses.

However, many African countries lack adequate local research capacity in this area. In response to a strong demand from its member countries, AfricaRice is progressively helping develop a work force of national researchers trained to apply molecular biology techniques critical to solving agricultural problems.

For Dr. Ndjiondjop, the overall strategy is to advance Africa toward the concept of "modern breeders" to efficiently exploit this potential for food security in Africa.

"The USAID-sponsored PhD training was the starting point of this strategy, which has contributed to the strengthening of the capacity of the national agricultural research and extension systems (NARES) and has a significant impact on agricultural research in West Africa," said Dr. Ndjiondjop. "For instance, Kam Honoré now leads the molecular laboratory established in his home country."

Dr. Ndjiondjop is the driving force behind molecular biology research at AfricaRice relating resistance to a number of biotic constraints. She and her team have trained more than 60 NARES researchers, including PhD and MSc students from Africa, in molecular breeding.

AfricaRice is actively helping the NARES acquire the necessary skills and equipment to facilitate breeding involving MAS. Its modern biotechnology facility in Cotonou, Benin, is used for rice breeding and enables national partners and students to learn on the job or gain hands-on experience.

"At AfricaRice, I have not only been trained in molecular breeding and statistical analysis of research data but I was also exposed to the techniques of managing germplasm and field research experiments," said Mounirou Sow. Thanks to this thorough background, he has been selected for the multiyear training program of CGIAR's Generation Challenge Programme (GCP). He is now involved in sharing his knowledge and skills with his colleagues from various countries.

"The hands-on experience gained by the students through their involvement in collaborative research, training programs, and technology transfer projects is very valuable," explained Dr. Ndjiondjop.

The trainees also benefit greatly from the partnerships that AfricaRice has developed with advanced research institutions, particularly in France (Institut de recherché pour le développement and Centre de coopération internationale en recherche agronomique pour le développement) and the United States (Cornell University), and through the GCP, CGIAR sister centers—the International Center for Tropical Agriculture and the International Rice Research Institute—as well as with national programs and universities in Africa.

R. RAMAN/AFRICARICE (3)

YOUNG AFRICANS, such as Mounirou Sow from Niger, who have been trained in the AfricaRice biotechnology laboratory are dedicated to applying molecular breeding and transferring the technology to other staff members in their respective countries (*above*). AfricaRice's biotechnology facility in Cotonou, Benin, enables national partners and students to learn on the job or gain hands-on experience in marker-assisted breeding.

Adequate infrastructure

Realizing the importance of adequate research infrastructure in national laboratories to ensure that scientists can apply their newly acquired skills when they return to their countries, Dr. Ndjiondjop and her team have helped purchase equipment and established the first national molecular biology laboratories in four West African countries (Burkina Faso, The Gambia, Guinea, and Mali).

"Trained national staff members need to have these facilities to introduce MAS into their breeding programs and to transfer resistance genes into elite varieties," said Dr. Ndjiondjop. Moreover, national scientists can use these facilities to apply molecular techniques and MAS in many different crops, not just rice.

AfricaRice is now helping the national programs to run their molecular laboratories, through molecular breeding projects being implemented in Burkina Faso, Mali, and Nigeria, funded by the GCP.

It is also helping its partners to establish new molecular biology laboratories or upgrade the capacity of existing ones in several West African countries involved in USAID-West and Central African Council for Agricultural Research and Development (CORAF/WECARD) projects.

"We will continue training our national partners in molecular techniques and MAS through a genetic and genomic platform focusing on low-cost, high-throughput genotyping based at AfricaRice," said Dr. Ndjiondjop.

The platform will facilitate the expansion of molecular research activities throughout sub-Saharan Africa for rapid development of new varieties. It will also help update the knowledge of conventional breeders in molecular breeding and help them understand the tools, statistical software, and experimental designs required for effective use of molecular markers.

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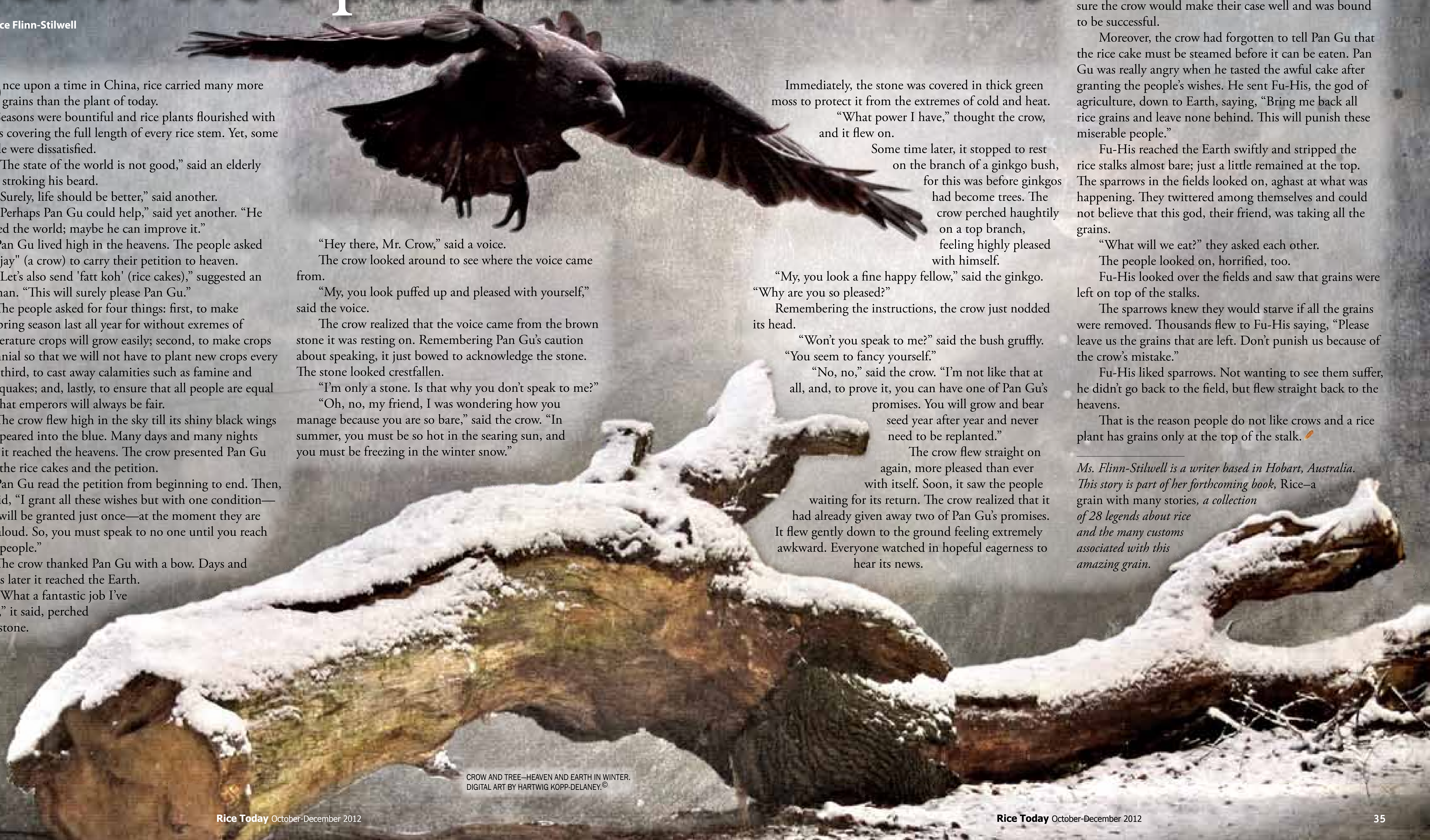
How rice panicles came to be

by **Alice Flinn-Stilwell**



Once upon a time in China, rice carried many more grains than the plant of today.

Seasons were bountiful and rice plants flourished with grains covering the full length of every rice stem. Yet, some people were dissatisfied.

"The state of the world is not good," said an elderly man, stroking his beard.

"Surely, life should be better," said another.

"Perhaps Pan Gu could help," said yet another. "He created the world; maybe he can improve it."

Pan Gu lived high in the heavens. The people asked "woojay" (a crow) to carry their petition to heaven.

"Let's also send 'fatt koh' (rice cakes)," suggested an old man. "This will surely please Pan Gu."

The people asked for four things: first, to make the spring season last all year for without extremes of temperature crops will grow easily; second, to make crops perennial so that we will not have to plant new crops every year; third, to cast away calamities such as famine and earthquakes; and, lastly, to ensure that all people are equal and that emperors will always be fair.

The crow flew high in the sky till its shiny black wings disappeared into the blue. Many days and many nights later, it reached the heavens. The crow presented Pan Gu with the rice cakes and the petition.

Pan Gu read the petition from beginning to end. Then, he said, "I grant all these wishes but with one condition—they will be granted just once—at the moment they are said aloud. So, you must speak to no one until you reach your people."

The crow thanked Pan Gu with a bow. Days and nights later it reached the Earth.

"What a fantastic job I've done," it said, perched on a stone.

"Hey there, Mr. Crow," said a voice.

The crow looked around to see where the voice came from.

"My, you look puffed up and pleased with yourself," said the voice.

The crow realized that the voice came from the brown stone it was resting on. Remembering Pan Gu's caution about speaking, it just bowed to acknowledge the stone. The stone looked crestfallen.

"I'm only a stone. Is that why you don't speak to me?"

"Oh, no, my friend, I was wondering how you manage because you are so bare," said the crow. "In summer, you must be so hot in the searing sun, and you must be freezing in the winter snow."

Immediately, the stone was covered in thick green moss to protect it from the extremes of cold and heat.

"What power I have," thought the crow, and it flew on.

Some time later, it stopped to rest on the branch of a ginkgo bush, for this was before ginkgos had become trees. The crow perched haughtily on a top branch, feeling highly pleased with himself.

"My, you look a fine happy fellow," said the ginkgo. "Why are you so pleased?"

Remembering the instructions, the crow just nodded its head.

"Won't you speak to me?" said the bush gruffly. "You seem to fancy yourself."

"No, no," said the crow. "I'm not like that at all, and, to prove it, you can have one of Pan Gu's promises. You will grow and bear seed year after year and never need to be replanted."

The crow flew straight on again, more pleased than ever with itself. Soon, it saw the people waiting for its return. The crow realized that it had already given away two of Pan Gu's promises. It flew gently down to the ground feeling extremely awkward. Everyone watched in hopeful eagerness to hear its news.

Afraid to tell the truth, the crow lied, "Pan Gu says we do not need the changes we asked for. Everything on Earth is perfectly alright."

Everyone was terribly disappointed. They had been sure the crow would make their case well and was bound to be successful.

Moreover, the crow had forgotten to tell Pan Gu that the rice cake must be steamed before it can be eaten. Pan Gu was really angry when he tasted the awful cake after granting the people's wishes. He sent Fu-His, the god of agriculture, down to Earth, saying, "Bring me back all rice grains and leave none behind. This will punish these miserable people."

Fu-His reached the Earth swiftly and stripped the rice stalks almost bare; just a little remained at the top. The sparrows in the fields looked on, aghast at what was happening. They twittered among themselves and could not believe that this god, their friend, was taking all the grains.

"What will we eat?" they asked each other.

The people looked on, horrified, too.

Fu-His looked over the fields and saw that grains were left on top of the stalks.

The sparrows knew they would starve if all the grains were removed. Thousands flew to Fu-His saying, "Please leave us the grains that are left. Don't punish us because of the crow's mistake."

Fu-His liked sparrows. Not wanting to see them suffer, he didn't go back to the field, but flew straight back to the heavens.

That is the reason people do not like crows and a rice plant has grains only at the top of the stalk.

Ms. Flinn-Stilwell is a writer based in Hobart, Australia. This story is part of her forthcoming book, Rice–a grain with many stories, *a collection of 28 legends about rice and the many customs associated with this amazing grain.*

CROW AND TREE—HEAVEN AND EARTH IN WINTER.
DIGITAL ART BY HARTWIG KOPP-DELANEY.©

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What's cooking?

Laotian steamed sticky rice with eggplant dip

by **Sue Pretty** and **Sysomphane Sengthavideth**

Steamed sticky rice is an essential part of every meal in Lao PDR. In most cases, it is preferred to regular steamed rice. True to its name, steamed sticky rice sticks together in one big heap.

In Lao PDR, the best way to eat sticky rice and eggplant dip is with your hands. And, this is how it is done: simply tear a bite size of rice from the sticky rice heap, roll it into a small ball, and enjoy with grilled eggplant dip or any Lao dish of your choice.

CHRIS QUINTANA (2)

Khao niao (Steamed sticky rice)

Ingredients

1 kg sticky rice
3 liters water (for soaking)

Directions

Rinse the sticky rice under running water until the water runs clear. Soak the rice in the water for 2–3 hours. Soaking the rice will reduce the cooking time, so soak for as long as possible.

Once soaked, drain the rice, removing all excess water, then place the sticky rice into a steaming basket and begin to steam. After about 30 minutes, turn the rice over and further steam for 10–15 minutes until cooked.

Set aside.

Jeow mak keua (Grilled eggplant dip)

Ingredients

500 grams Japanese eggplant
6 pieces shallots
10 cloves garlic
10 pieces chilies
4 tbsp fish sauce
1 tsp lime juice
A handful of coriander leaves, finely chopped
Salt to taste

Directions

Grill the eggplants, chillies, shallots, and garlic until the skins are charred. Remove from the grill and cool. Then peel the eggplants, shallots, and garlic and chop coarsely.

Using a mortar and pestle, pound the chilies and salt. Add the shallots and garlic and continue to pound until all the ingredients are crushed.

Next, add the eggplants, lime juice, and fish sauce and pound again until the ingredients are well combined. Lastly, mix in the coriander leaves.

Serve with the steamed sticky rice.

Tip: Do not use water when peeling the skin of the eggplants—they will become soggy and will also lose their incredible smoky flavor.

Serves 3–6.

Sue lived in Lao PDR for 4 years before moving to the Philippines in 2011 with her husband, IRRI experiment station head Leigh Vial. She met Dtae at the Wildlife Conservation Society in Lao PDR, where they both worked on tiger conservation. During social gatherings, which often revolved around food, Sue found Laotian dishes delicious and seriously addictive.

Dtae is now studying for her master's degree at the University of the Philippines Los Baños. Sue and Dtae, together with some Lao students, regularly meet to cook, chat, laugh, and enjoy Lao food.

Watch Sue and Dtae demonstrate how to prepare this appetizing Laotian dish in a 6-minute video on YouTube at http://snipurl.com/lao-sticky-rice.

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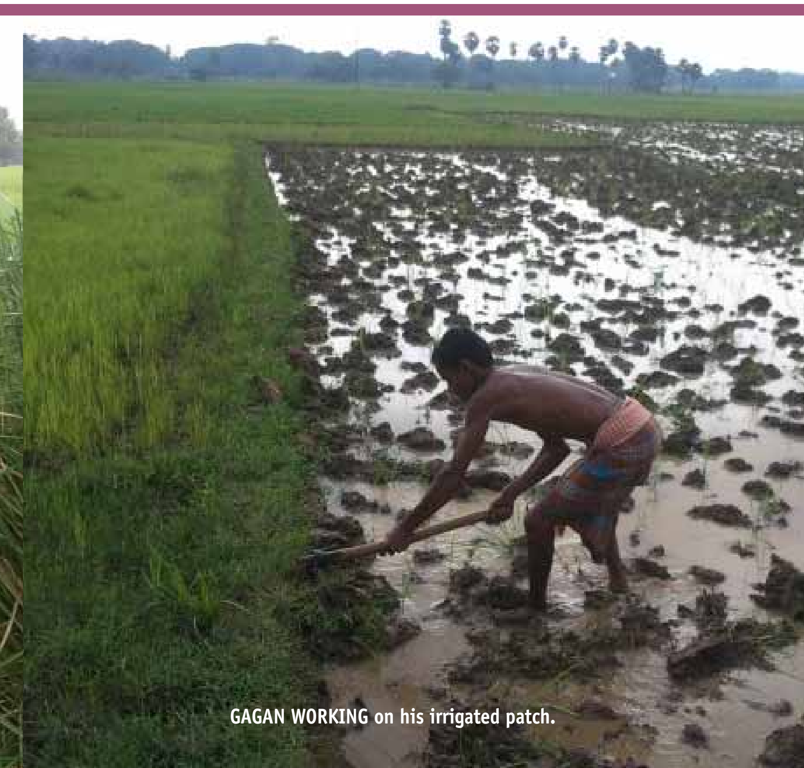
SAM MOHANTY with Gagan and other farmers.


GAGAN WORKING on his irrigated patch.


NEW TUBE well.

SAMARENDU MOHANTY (3)

A day in the life of an Odisha rice farmer

by **Samarendu Mohanty** and **Sampitri Baruah**

In mid-July this year, we visited Bhuan, a small farming community of nearly 50 households in the Indian state of Odisha, to spend a day with Gagan Bihari Pradhan and his family. The village is located 40 kilometers southeast of the state capital, Bhubaneswar, near the bank of the Dhanua River. The day we were visiting, the river looked like a small canal—less than 5 meters wide, but we were told by the villagers that the width of the river swells to more than 5 kilometers in the rainy season and that the entire village, including rice fields is inundated by the river.

Gagan has been involved in farming since he dropped out of middle school nearly 30 years ago. Currently, he has less than 1 hectare of farm land in two small separate patches in different parts of the village and he farms another patch on a shared-crop basis. After the rice harvest, he grows green gram, black gram, potato, and point gourd on parts of his land in summer. Recently, he has begun raising mushrooms for more income. He has a small backyard garden behind his house in which he grows vegetables for his own consumption. He has one cow, two young calves, and a bullock.

Apart from his farm operation, he works as a daily laborer for half of the year. During the rice-growing season, he works for 90 days in other farmers's fields in the village apart from working in his own. Off-season, he works in Bhubaneswar or nearby towns for 90 days and the remaining 90 days are spent on the farm, growing various summer crops. His wife takes over farming operations in the early summer when Gagan works in Bhubaneswar or nearby towns. In addition, she is involved in threshing and storing paddy.

Our rough calculation suggests that his total gross annual income last year from selling surplus farm produce (paddy, mushroom, milk, black gram, green gram, potato, and point gourd) and his on- and off-farm wages was close to Rs. 60,000 (approximately US$1,100).

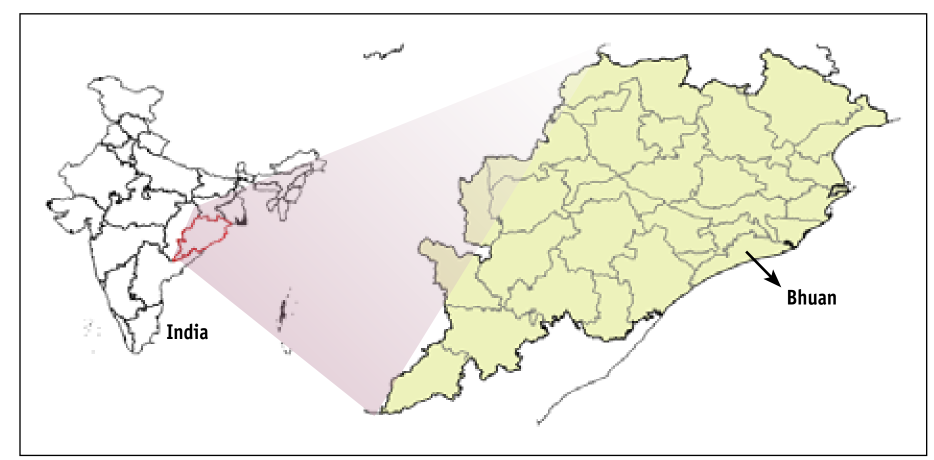
Life from sunrise to sunset and beyond

When we visited, Gagan's day started at 6 a.m. By that time, his wife had already finished collecting fresh cow dung from their cowshed. After having tea and puffed rice, he took his cattle out for feeding and finished a few additional activities around the house. Then, he started carrying farm manure in a basket on top of his head to his field, which is nearly 200 meters from his house. He made 10 trips in nearly 2 hours, carrying a total of 200 kilograms of manure. Meanwhile, his wife prepared breakfast for the family and helped their two younger daughters get ready for school (the second daughter is in high school and the youngest in primary school). The eldest daughter, who was recently married in a nearby village, was also there on her annual vacation.

When Gagan returned home from the field at 9 a.m., his wife served him a big bowl of rice, fried potatoes, and onions. Then, Gagan headed back to his field where rice seedlings were already visible after broadcasting the seed. He started cleaning bunds around his field and did some weeding until 12:30 pm. We watched him for a while, but, the heat and high humidity forced us to find some relief from the scorching sun under the shade of a nearby tree. After a couple of hours, other farmers working nearby, including Gagan, joined us to take a break from the unbearable heat.

During our conversation, one thing was very clear: these farmers are frustrated with their stagnant lifestyle. They believe the world around them is changing rapidly. They are very determined to educate their kids so that they can get out of farming and live a better life.

After talking with them, we headed back to Gagan's house. On the way, Gagan stopped to take care of his mushroom crop; then, upon reaching home, he bathed in the nearby river. While sitting on the veranda of his house, we asked the eldest daughter, who was providing



us with good company, if she was married to a farmer. She replied "no," explaining that, although her husband belongs to a farm family, he works for a private company in Bhubaneswar.

She also remarked that nothing has changed—her father's plight has not improved at all over the last 20 years, despite putting in 12 hours of hard labor every day, 365 days a year.

During this time, Gagan had left on his bicycle and returned in 10 minutes looking quite frustrated. His daughter said he wanted to give us fresh coconut water and he was looking for someone who could climb the coconut tree. Somehow, he managed to get a few young coconuts with the help of a long bamboo branch and he served us some refreshing coconut water. It was inspirational to see his hospitality despite knowing that he would not be gaining anything from these strangers who were intruding into his family life.

After lunch Gagan normally takes a 1-hour nap, so we decided to go to a rice mill on the outskirts of the village to eat our lunch and we returned an hour later. After his nap, our host headed to his patch of land on the other side of the village. He showed us with beaming pride his new tube-well irrigation system and he was hoping that we could somehow help him get his 50% subsidy (Rs. 35,000/$625) from the government. He has been waiting for that subsidy for several months. We politely explained that we have no connection with the government to help him with this. Apparently, his irrigated patch has been plowed only a few times, so he was waiting to transplant, hoping for some rain so he could avoid the irrigation water pumping cost. He worked there for 3 hours until 6 p.m., fixing the ground around the irrigation system so that the water would flow evenly to all parts of his field.

At 6 p.m., before we returned to Bhubaneswar we inquired about his activities for the rest of the evening. He replied that he will feed his cattle and will do other work around the house. Then, he will go to the village market around 7 p.m. to get some groceries and other items. His day will end after playing cards with friends, calling it a day between 10 and 11 p.m.

We left with heavy hearts, thinking that Gagan and millions like him are caught in the poverty trap with no escape. But, we were also overwhelmed by his hospitality and amazed how content he appears to be with his life. Despite all his problems and uncertainties, he seems to be living life to the fullest. He may not realize it, but his hard work and that of millions more small farmers just like him keep food prices affordable and help feed 1.2 billion Indians.

Dr. Mohanty is an economist and head of IRRI's Social Sciences Division while Ms. Baruah is a consultant in IRRI's Social Sciences Division.

SRI: An evolving learning alliance

by Bas Bouman

Recently, quite a number of stories have been in the media about what has been called a "novel approach to rice cultivation," namely, the System of Rice Intensification (SRI). In a nutshell, it is an agroecological methodology designed to increase the productivity of irrigated rice by changing the management of plants, soil, water, and nutrients. Although SRI started as a set of basic essential "principles," it has evolved into a participatory learning alliance that aims to offer farmers a suite of management practices to choose from and adapt according to their local conditions. This flexibility makes SRI difficult to evaluate; however, it offers good opportunities for linking with other institutions and networks that are developing improved rice management practices for farmers.

Out of Africa (Madagascar)

In 1961, a French Jesuit missionary, Henri de Laulanié, began trying to help farmers in the highlands of Madagascar to increase their production of rice and other crops. By 1983, he had come up with a rice-growing methodolgy that ultimately became known as SRI. Finally, in 1993, 2 years before his death, he published his results in the journal *Tropicultura*, which brought together three principles that define SRI: planting young seedlings, planting single seedlings, and applying minimal irrigation water to keep the soil just at or below saturation. These basic elements are complemented by "general principles of improved rice cultivation."

Shifting SRI

SRI has since spread outside of Madagascar and evolved into a suite of flexible principles that can be adapted to local conditions. The SRI International Network and Resources Center[1] lists the following SRI practices: very young rice seedlings (8–12 days old) need to be carefully and quickly transplanted in single plants/hill, and widely spaced in a square grid pattern of 25 × 25 cm or more; soil must be kept moist but well drained with good structure and organic matter; soil nutrients must be augmented, preferably with compost; and early weeding must be regularly done either mechanically or manually, through which weeds are incorporated into the soil.

However, in some places, different sets of shifting practices are being recommended and still billed as SRI. For example, transplanting older seedlings or transplanting more than one seedling per hill is considered to be SRI if site-specific conditions call for it.

In Cambodia, farmers using so-called SRI transplant 25-day-old seedlings, sometimes with more than one seedling per hill, and not always in square patterns. Although compost or manure is preferred, chemical fertilizers are not excluded and their use is even encouraged by some SRI practitioners such as those in the Indian state of Tamil Nadu.

Assessing SRI

The "relaxation" of the original SRI principles, the flexible inclusion of new components, and the integration of other improved management practices have made comparisons between SRI and non-SRI approaches difficult. This makes controlled experimental assessment of the benefits of SRI and evaluation of the gains that SRI practitioners might realize highly ambiguous.

When observing farmers using SRI in the field, the categorical clarity of SRI (as defined by de Laulanié) disappears and the boundary with other best management practices begins to dissolve. A 2010 review of adoption studies of SRI concluded that "Field observations and discussions with farmers very quickly confirm that the label 'SRI' encompasses a range of different implementations that depend heavily on the contingencies of farmers' attitudes, household capacities, socioeconomic contexts, and local institutional factors, as well as agroecological constraints."[2]

SRI as a learning alliance

Some see SRI alternatively as a "movement" or a "learning alliance" to improve the livelihood of rice farmers by increasing yield and resource-use efficiency. This alliance is bringing together farmers, extension and development agents, and scientists to jointly adapt, integrate, and test improved rice management technologies.

Following in de Laulanié's footsteps, farmers are encouraged to experiment in their own fields to find the best practices that suit their own conditions. They may start with the three original fundamental elements but may ultimately end up with a set of practices that are considerably different.

If one can offer farmers a menu of practices that are science-based and have a solid track record of performance and that can be tested, adapted, and integrated by farmers locally, then one can greatly improve farmers' production systems. New tools, such as IRRI's leaf color chart, and other new technologies (varieties, natural resource management options, etc.) being developed by researchers in the Global Rice Science Partnership (GRiSP) can be easily linked to the SRI movement.

Dr. Bouman became the new director of GRiSP on 1 September 2012. For more on SRI along with access to a detailed SRI report, What is the System of Rice Intensification (SRI) and where is it going?, *by Dr. Bouman, go to http://snipurl.com/irri-sri.*

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[1] http://sri.ciifad.cornell.edu/index.html.
[2] Glover D. 2010. The System of Rice Intensification: Time for an empirical turn. NJAS-Wageningen Journal of Life Sciences 57(1):217-224.

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