Farmers learn from on-farm research

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RAJSHAHI, BANGLADESH

Outside of the city, one side of the road is lush and green with irrigated dry season rice. The other side is fallow, dusty, and brown—there's not even enough water for the weeds. The farmers who work this land, who follow the traditional cropping pattern of growing only one crop of wet season rice a year, must wait for the rain to come in July before planting.

Now, thanks to deep tube wells, the cropping pattern has been shifting around Rajshahi to irrigated dry season rice followed by a rainfed wet season crop—and dramatically increasing output.

Mr. Mohamed Maij Uddin and his family are collaborators with the Rainfed Lowland Rice Research Consortium. Rajshahi, which means "king's place", is one of the Consortium's five key sites.

The head of family, who was away when we visited, has been farming for nearly 25 years with his wife. His sons, Salah Uddin, 28, and Omar Faruk, 25, are actively involved in the farm. There are 11 children in the family, although two of the young men are no longer at home. All of the children have studied through secondary school.

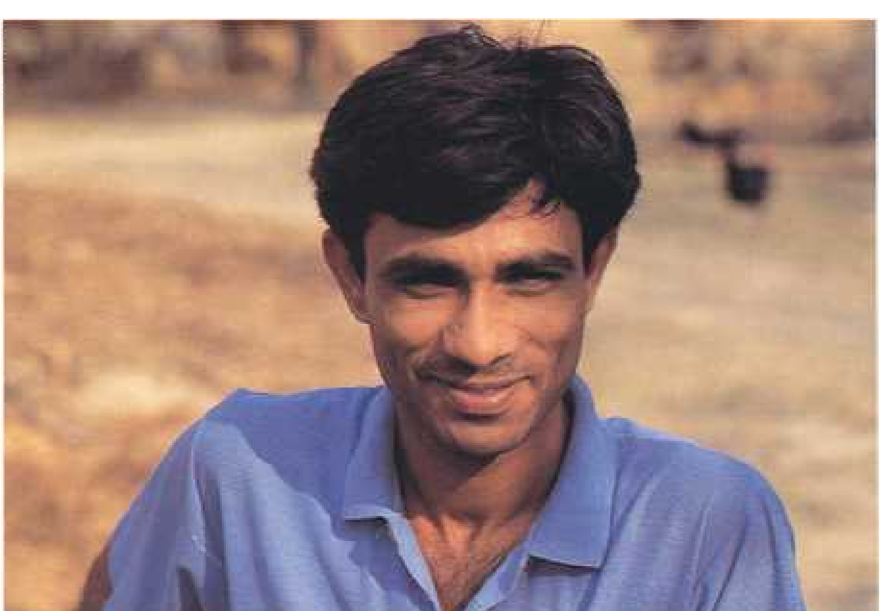
"We are getting educated to help our father in agriculture," says Salah, who has a master's degree. But he really hopes to get a job in industry some day. Meanwhile, he and Omar supervise the laborers working in the fields.

The family has been collaborating with Consortium researchers on direct dry seeding of rice. They became involved in on-farm research because their father is interested in rice research and motivated to participate, says Salah.

R. Cabrera

And yes, the sons know about IRRI. Recites Salah: "IRRI is an international institute that does research on rice." The goal of the family's current collaborative work is to spread the potential risk of drought damage by carrying out four seedings over 2 months.

"Seeding is done every 15 days," explains Salah. "The first one is done around the first of June, then a second in a different plot around June 15." Two more seedings follow.



R. Cabrera

Salah Uddin helps his father on the farm, but his real dream is to work in industry.

"We are interested in doing on-farm research in the years to come. If the trials are successful, we'll continue to collaborate. We are learning many things from the work."

Thanks to deep tube wells, farmers in Rajshahi can now grow an irrigated dry season rice crop followed by a rainfed wet season crop, dramatically increasing output.

The first seeding was done in a dry field and didn't germinate well. When the first rains finally came, however, the fields turned green. The fourth seeding was a little late, and a drought came during flowering.

The first, second, and third seedings produced a good yield: 3.5-4 tons per hectare. "This technique helps to eliminate the risk of drought because there's no need to determine the best time to seed," Salah says.

Excessive weeds, however, are a limitation with direct seeding during the wet season, he points out. Normally, the soil is puddled and seedlings that are about one month old are transplanted.

"We'll experiment again in the next wet season, which starts in July. This time we'll do two or three seedings on 2 *bighas* (0.26 hectare)," Salah says. Three or four days after harvesting the crop in November, the family will plant chickpea to take advantage of residual moisture.

The family's biggest constraint is water. "If there's no water, we cannot plant," explains Salah. He also mentions that fertilizer is often not available and insects and diseases sometimes cause losses. They use a granular insecticide to combat stem borer.

"We are interested in doing on-farm research in the years to come. If the trials are successful, we'll continue to collaborate," says Salah. "We are learning many things from the work." ■

Shaking up theories about blast pathogen diversity

In three valleys of western Bhutan, an unprecedented outbreak of rice blast disease occurred in 1995. Farmers lost their entire crops to the disease in the most severely affected areas.

Although commonly observed in fields in Bhutan, blast had apparently never before caused serious losses. So why then?

"DNA fingerprinting of the blast pathogen (*Magnaporthe grisea*) revealed an extremely diverse population in the affected areas. So a novel introduction wasn't the reason for the epidemic," says Dr. Robert Zeigler, IRRI plant pathologist.

After talking with farmers and examining weather records, scientists concluded that unusual weather at critical crop stages probably triggered the indigenous pathogen population to explode into an epidemic.

But there may be more to it than that. Earlier work by Dr. Zeigler and his colleagues to characterize the blast pathogen population in the Himalayas of India revealed genetic diversity far greater than that of populations previously studied.

"There's strong evidence that sexual recombination may be occurring in the field," Dr. Zeigler says. "This finding challenges assumptions that *M. grisea* reproduces strictly by cloning itself and that different lineages are genetically isolated."

The implication: even apparently simple blast pathogen populations in the Himalayas may be the source of new types of pathogen that could potentially threaten millions of hectares of rice growing in the Gangetic plains.

C. Zeigler

When an unprecedented outbreak of rice blast disease occurred in Bhutan, Robert Zeigler (left) went to investigate the reasons.

Characterizing rainfed lowlands accurately

For years, scientists who have tried to characterize the rainfed lowland rice areas of the world have ended up frustrated.

The sheer diversity and unpredictability of the climate make it extremely difficult to reliably classify the rainfed lowland areas into a particular subecosystem category of favorable, submergence-prone, drought-prone, or drought- and submergence-prone.

"A given area could be classified as being in one subecosystem this year but in a different subecosystem the next year," explains Dr. Virendra P. Singh, IRRI agronomist. "Consequently, scientists could not develop a technology and recommend it with confidence to farmers."

But things have changed for the better. Using remote sensing and geographic information systems, Dr. Singh and his collaborators developed a new methodology to reliably characterize and delineate an area into a subecosystem category.

Twenty-four districts covering about 3 million hectares in eastern Uttar Pradesh, and some districts in Bihar, Madhya Pradesh, and Assam, India, were used to test the methodology in a massive collaborative effort involving researchers from the Indian Council of Agricultural Research, agricultural universities in India, and IRRI; workers from state remote-sensing application centers and nongovernment organizations; and farmers.

"We found that in 9 out of 10 cases, the classification derived using this system is correct," Dr. Singh says.

Scientists can now pinpoint where specific technologies will be useful for farmers—and just as importantly, where they will not. "For example, varieties with tolerance for drought can be recommended—with confidence—as appropriate for an area. This couldn't be previously done," Dr. Singh says.

Rainfed lowland rice varieties and associated crop management techniques are now being tested in farmers' fields in eastern India based on these new classifications.

Expanding the research base

After only 5 years' of existence, the Rainfed Lowland Rice Research Consortium (RLRRC) is having a major impact on its targeted ecosystem.

The challenges facing the Consortium are huge, including increasing productivity, sustaining these increases, and doing so with technologies that could be adopted by resource-poor farmers.

"Consortium scientists are working to expand and strengthen the research base for the rainfed lowland rice ecosystem to generate new technologies that have local, regional, and international applications," says Dr. Robert Zeigler, leader of IRRI's Rainfed Lowland Rice Ecosystem Program. IRRI joined forces with relatively strong national agricultural research systems (NARSs) from Bangladesh, India, Indonesia, the Philippines, and Thailand to form the Consortium. Initially funded only by the Asian Development Bank (ADB), the consortium now also enjoys the support of the Dutch Government.

Participating institutions have embraced the multidisciplinary research model embodied in the consortium approach and have restructured their relevant programs accordingly. As a result, there are now fully decentralized rainfed lowland rice breeding programs in northeast Thailand, Indochina, and eastern India.

"These programs built upon local farmers' knowledge and germplasm, and now have highly productive, adapted, advanced lines under evaluation in farmers' fields," Dr. Zeigler says.

"The Consortium is really a major step in the evolution of CGIAR and NARS partnerships in research," says Dr. Zeigler. "It has now reached the stage where complex and potentially high-payoff strategic research is being conducted in a truly collaborative mode."

Farmer-participatory breeding

Why aren't more farmers using modern rainfed rice varieties? The question is a serious one for breeders. They realize that the rainfed rice environments are complex and that their breeding strategies must take this complexity into account.

"Farmer input to the breeding process can be most useful in the beginning, at the problem identification stage, and in the later phases of selection," says Dr. Ken Fischer, IRRI deputy director general for research. "This will help to ensure that rice varieties developed are selected and evaluated for specific adaptation to farm microenvironments."

During a "think-tank" meeting on farmer-participatory breeding at IRRI in March 1996, participants from around the world shared experiences and discussed expectations of farmer participatory breeding projects. Scientists, research managers, farmers, and government and nongovernment representatives attended.

IRRI scientists have been making use of the farmer-participatory breeding concept for some time now. Advanced breeding lines originating from the Thai-IRRI Shuttle Program are being tested in farmers' fields in northeastern Thailand and in eastern India. Lines from populations developed using modern and traditional varieties are under evaluation and selection in farmers' field in Bangladesh.

Perfecting direct dry seeding of rice

Scientists and farmers are working together to perfect the practice of dry seeding rice. The ultimate goal is to get more farmers—where appropriate—to adopt this economical, time-saving establishment technique in which rice seeds are broadcast directly in dry plowed or moist unpuddled fields.

In four villages in Pangasinan Province, Philippines, dry seeded rice systems were found to outperform transplanted systems. Although rice yields were similar in the two systems, dry seeded rice farms produced higher total annual income because enough residual soil moisture remains to grow mungbean after rice. "Dry seeded rice uses rainfall more efficiently than transplanted rice," says Dr. Sadiq Bhuiyan, IRRI water resource specialist.

After sowing, dry seeds can remain viable in dry soil for 15-20 days. They germinate with the first significant rains. "In the transplanted rice culture, rice cannot be established until enough rain has accumulated for plowing and puddling" says Dr. To Phuc Tuong, IRRI water management engineer. So by dry seeding, farmers could gain a month or two that otherwise would be spent preparing land, allowing them to potentially grow a second crop.

Farmers can also benefit from another simple practice. In a different study, research on 50 farms showed that, through better land leveling and bund management, yields of dry seeded rice would be increased by about 1 ton per hectare. "Rainwater capture and use is more efficient in fields that are well leveled and partitioned into plots," says Dr. Bhuiyan. ■