

# Catching up in southwestern Bangladesh

by Sophie Clayton



*A combination of water, fish, rice, and upland crop management research is underway to help millions of the poorest farming families in Bangladesh living in the coastal zone, the region most vulnerable to the impacts of climate change*

IRRI (2)

**“R**ice is our national occupation,” says rice farmer Altaf Boyati. “My father and grandfather cultivated rice. As a farmer, I am also cultivating rice.”

Mr. Boyati lives in the southwestern coastal zone of Bangladesh, where farmland has more than its fair share of water and salinity challenges and where poverty remains a chronic problem. But now, Mr. Boyati and other local farmers are getting help to catch up with the rest of the country, where agricultural gains have contributed to declining poverty. As part of the Ganges Basin Development Challenge of the CGIAR Challenge Program on Water and Food (CPWF), fresh approaches to improving water management and the use of high-yielding rice varieties, combined with aquaculture, will give farmers more

effective options to increase food production and profitability.

## Steps out of poverty

Bangladesh is one of the most densely populated and poorest countries in the world. According to the World Bank, about one in three Bangladeshis is poor—slightly more in rural areas.

The good news is that, over the last decade, the percentage of people living in poverty has declined. Three agricultural factors have contributed to this. First, the adoption of high-yielding rice varieties for both the rainy and dry seasons; second, private investment in groundwater pumping to irrigate rice during the dry season; and third, greater use of inputs, especially fertilizer.

With higher yield potential from new rice varieties and the ability to

grow irrigated rice during the dry season (*boro* rice), farmers can more consistently—and with lower risk—produce more rice. More rice means more to eat, more to sell, and thus more income for rice farmers. And, with more rice on sale in markets, rice prices are more likely to stay affordable for even the poorest consumers.

Unfortunately, farmers in the southwestern coastal zone have missed out on the benefits these agricultural changes have delivered. A recent survey of 1,200 rural households across the coastal zone found that about 80% of the people were living below the poverty line of US\$1.25/day, compared with the national average of 40%.

Here, farmers grow traditional, tall, low-yielding rice varieties during the rainy season, followed by a non-

irrigated, low-yielding legume or fallow during the dry season. In most of the coastal zone, high-yielding varieties are not grown because the water is often too deep during the rainy season due to poor water management.

## Water woes

Water—whether too much, too little, or too salty—is a major constraint to improved agricultural production in the southwestern zone.

Bangladesh is one of the most water-abundant countries in the world. It has an annual rainfall of 1,500 to 3,000 mm yet it has several water challenges, according to Aditi Mukherji, a water expert formerly with the International Water Management Institute.

“For one, much of coastal Bangladesh is a part of an active delta and highly influenced by tidal surges and salinity intrusion,” she said. “So, in nonrainy months, availability of fresh water is scarce and management

of brackish water is a critical issue. Second, relatively flat terrain, clayey soils, and high rainfall lead to severe waterlogging, inundation, and siltation of internal drainage channels.”

## Preventing floods and salt-water intrusion

In the 1960s and 1970s, in order to help reduce the devastating impact of tidal floods and saline water intrusion on the people of the southwestern coastal zone, embankments were built around the lands between the large rivers in the region to create “polders”—or inland islands protected by embankment walls.

Polders have proven their worth in buffering farmers against the onslaught of tidal floods and salinity. The World Bank stated in its 2010 report, *Economics of Adaptation to Climate Change—Bangladesh*, that, over the last 50 years, polders have contributed to “significantly

reduced damage and losses from extreme climatic events over time, especially in terms of deaths and injuries.” The report also attributes higher agricultural production, including rice, to the improved water management polders can deliver.

However, the reality of their effectiveness is much more complicated. Out of 123 polders in southwestern Bangladesh, many need to be repaired and upgraded to cope with the situation, let alone the predicted worsening conditions brought about by climate change. Internal canals, which are important for both drainage and storage of water in the wet and dry seasons, are often silted up. And, the sluice gates connecting the canals to the surrounding rivers are often leaky, badly damaged, or missing. Where the infrastructure is still functional, competing demands for water also mean control over what water goes into and out of the polder is more than a simple technical matter.



BANGLADESH FARMERS are working with research agencies to improve the productivity of their rice farms. Photo shows Dr. Liz Humphreys (seated far left), Dr. Manoranjan Mondal (seated with gray shirt), and Mr. Altaf Boyati (squatting wearing brown shirt).

“With many different farmers on a polder, it is inevitable that they will want to use their patch of land for different purposes,” explains Liz Humphreys, senior scientist at the International Rice Research Institute (IRRI) and leader of one of the five projects in the Ganges Basin Development Challenge. “One farmer may want to grow shrimp during the dry season, which requires salty water, while another may want to grow crops such as maize or rice, which require fresh water.

“Or, it could be as simple as one farmer wanting to drain his field because his rainy-season rice crop is almost ready for harvest, and so that he can establish a dry-season crop such as wheat or maize at the optimum time, while another farmer needs the water around for his standing crop,” she added.

### Upgrading water management

To realize the full potential of new diversified and intensified cropping systems, the roles of polders have to be revised. In addition to salinity control and tidal flood protection, the polders and their water management infrastructure have to satisfy other needs of the new cropping systems, including drainage, intake of fresh and saline water, and freshwater storage.

Water flows into, or out of, the polders via human-operated sluice gates and flushing pipes. During the rainy season, there is often extensive flooding in the polders due to heavy rainfall, with the flooding worst (in excess of a half-meter deep and longer lasting) in lower lying lands.

Yet, at low tide (which occurs twice a day), the water level in the surrounding rivers is often lower than the land, creating a chance for drainage. A systematic approach to drainage management would enable the growing of high-yielding varieties of rice in large areas.

In some polders, community water management groups manage the sluice gates. However, the operation of the gates is often influenced by the more powerful and affluent whose interests may be at

odds with the majority, that is, the poorest people whose livelihoods and food security depend on the productivity of the lands, which they often lease.

For example, when the lands need to be drained for rice, some may desire to bring yet more water into the polder because it also brings seed for their fish ponds, or because the highest lands need more water.

Manoranjan Mondal, a water scientist at IRRI, adds that 40% of the land owners are relatively wealthy absentee land owners. Typically, they are more willing to take risks as to what they do on their land in hope for higher returns. This can mean brackish-water shrimp farming; although risky, it can be more profitable than rice.

The International Water Management Institute is looking for ways to improve water governance and community-based water management on the polders. For Dr. Mukherji, tackling these water management challenges is critical for the region to reach its agricultural potential.

“We aim to show that, with investment in improved water management in polders, productivity can be greatly increased,” says Dr. Humphreys. “With our collaborators, we are developing, evaluating, and demonstrating new options that help farmers increase the productivity and profitability of their rice, other crops, and fish.”

### Better rice options

Until recently, the evaluation and demonstration of high-yielding rice varieties have been neglected in the coastal zone. Thus, few farmers grow modern varieties, so their rice farms remain locked in the past with low productivity. A major constraint has been that most high-yielding varieties are not tall enough to cope with “water stagnation” (prolonged periods of water with a depth of 0.3–0.5m).

“Farmers here tend to grow tall traditional rice varieties that protrude well above flood waters,” says Dr. Humphreys. “They transplant them when they are already quite tall and old, which is not optimal for high productivity.

“Plus, these traditional varieties mature late and they have less than half the yield potential of the modern varieties—limiting the amount of grain a farmer can produce,” she added.

Mr. Boyati has confirmed this by saying that he normally gets less than 2.5 tons per hectare of rice—just over half the national average of 4 tons a hectare and less than half the yield of the best high-yielding rice varieties grown

in trials on his farm.

Dr. Humphreys and her collaborators from the Bangladesh Rice Research Institute (BRRI) and BRAC, the largest NGO in the world, are testing new rice varieties and upland crops with higher yields that are better suited to the local conditions—including floods and

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THE GANGES Basin Development Challenge of the CPWF is conducting a trial on growing rice and freshwater fish simultaneously.

salinity—and that mature faster to allow multiple crops to be grown in one year.

Combining smart water management, that is, drainage at critical times, with shorter-duration, high-yielding rice varieties allows farmers to grow two to three crops per year and double or triple their food production.

### Successful demonstration

On Polder 30, Dr. Mondal and a group of farmers showed how it could be done. They isolated about 6 hectares farmed by 37 farmers within the polder by building a small embankment and associated ditch so they could drain the fields when they wanted to. A small bund also bisects the area to separate the high land from the lower land, thus preventing excessively deep water in the lower land.

The 2012 *aman* (rainy) season saw two rainfall events of around 250 mm, each within a very short period. The farmers systematically operated the sluice gate to drain at each low tide. In short, the excess water was drained within two days and no damage was done to the rice.

It’s a unique situation according to Dr. Humphreys, as the land inside the polders is not subdivided to

facilitate localized water management. She is an advocate for subdividing areas because this requires little investment, separates lower and higher lands, and enables affordable drainage—provided that the sluice gates are also managed systematically to enable drainage. However, for this to be carried out successfully, farmers need to have a synchronized planting and harvesting.

Also, improved drainage management would only be feasible with greater government support to improve the whole water management infrastructure of the polders. Dr. Humphreys hopes that this will come later once it is demonstrated that creating miniwatersheds can really boost food and economic productivity.

### Fish and rice together

In some of the more saline parts of the coastal zone, brackish-water shrimp are produced during the dry season. After the shrimp are harvested, the soil is left salty.

“These areas represent some of the most challenging environments for wet-season rice; but, with good water management, it is possible to grow rice in rotation with shrimp,” says Dr. Humphreys. “This also requires good drainage management because the brackish water must be drained before the monsoon season so that the rain can leach the salt from the topsoil before the rice is planted.”

The World Fish Center and the Bangladesh Fisheries Research Institute in collaboration with BRRI and IRRI have established a trial to optimize management of rice and shrimp production systems.

“The theory is that growing rice, instead of leaving the ground fallow between shrimp harvests, may break virus cycles that can otherwise obliterate the shrimp,” says Dr. Mondal. “Also, the shrimp can help build nutrients for the next rice crop—but it’s all yet to be proven; hence, the trial.”

The trial also includes growing rice and freshwater fish simultaneously. Tradeoffs exist between the needs of the rice plants

### CPWF Ganges Basin Development Challenge partners are also:

- Assessing the likely impacts of anticipated external drivers of change (such as changes in climate, river flows from India, population) on water resources of the coastal zone.
- Mapping where improved cropping system options (agriculture and aquaculture) could be adopted now, under current conditions, and under future scenarios.

and the fish, but there could also be synergistic benefits that increase overall production.

“It’s important we complete the trial before we make any recommendations,” says Dr. Mondal. “Aquaculture requires a huge investment to establish and we don’t know for sure yet if combining it with rice can help. The farmers believe it, but we need to observe and measure it first.”

“What we do know for this region is that farmers who want to grow rice to build their personal food security will have the capacity to do it with varieties that can cope well with salinity—but again, it always has to be combined with good community water management,” Dr. Mondal concluded. 🍌

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