Polder Tidings

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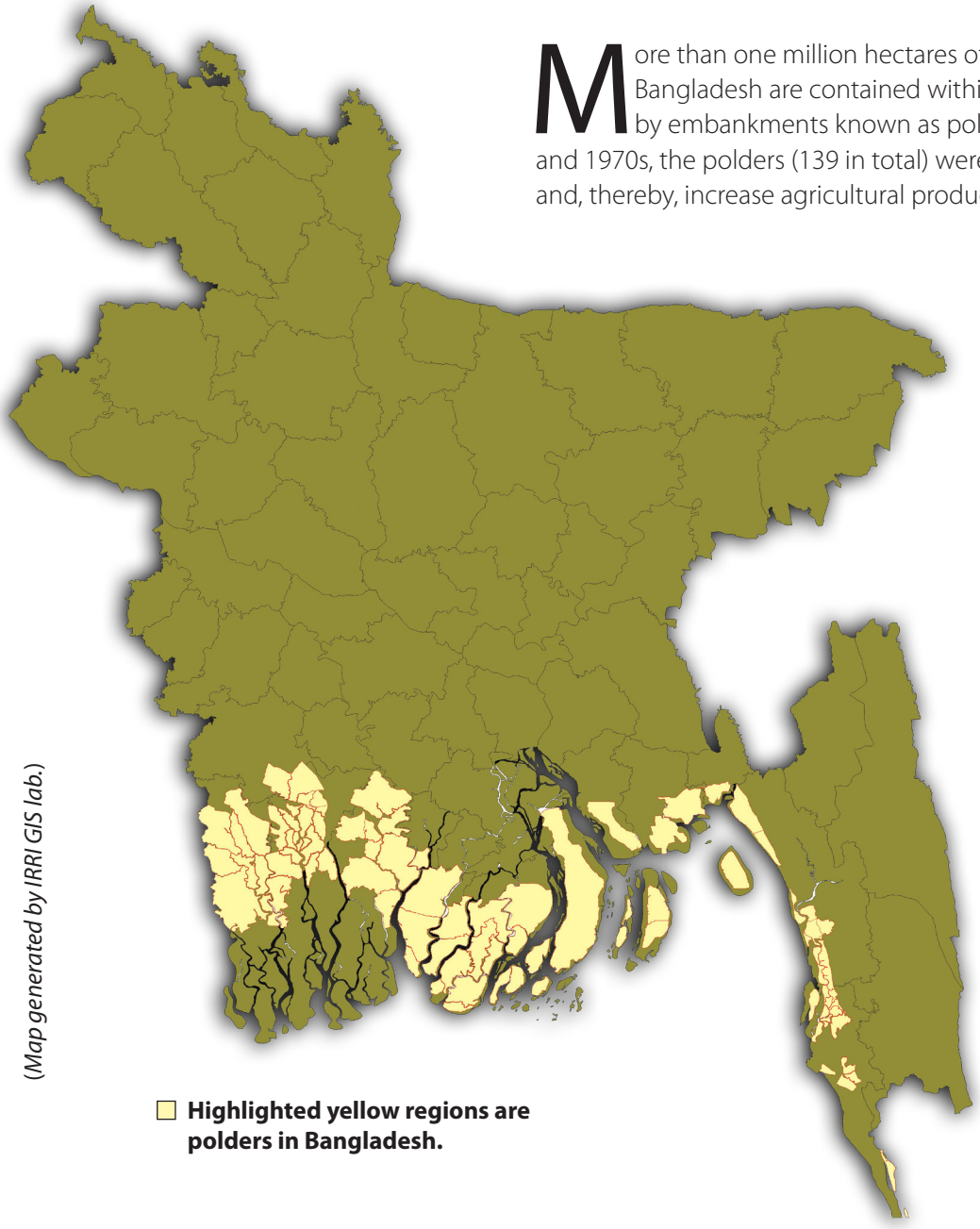
More than one million hectares of land in the coastal zone of Bangladesh are contained within low-lying tracts of land enclosed by embankments known as polders. Constructed during the 1960s and 1970s, the polders (139 in total) were designed to control tidal flooding and, thereby, increase agricultural production in coastal areas.



(Map generated by IRRI GIS lab.)

Highlighted yellow regions are polders in Bangladesh.

Inside

Unlocking the production potential in polders

By Sudhir Yadav

The Green Revolution significantly contributed to the food security of many developing countries including Bangladesh; ushering opportunities for self-sustaining economic growth and reducing poverty. However, the polder ecosystem of Bangladesh has yet to experience the impacts of the Green Revolution.

Central and northern Bangladesh is known for input-intensive rice-based system. Contrary to this, in coastal Bangladesh, it is hard to see anything green in the dry season.

Polder zones are vulnerable to the ill effects of climate change—rising sea level, and flooding. These caused variable salinity and other natural challenges that prevented the Green Revolution from bearing "fruits." Most of the farmers grow a single crop of traditional rice in a year. As a result, the entire ecological zone is home to millions of poor people and is regarded as a low agricultural productivity zone of the nation.

More than one million hectares of land in the coastal zone of Bangladesh are contained within polders. Unfortunately, the communities in these polders experience serious food insecurity and extreme poverty because of high population density and low productivity of agricultural and aquaculture production systems in the region.

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Farmers are transplanting traditional rice varieties in knee-high flooded conditions in polders of the coastal zone of Bangladesh.

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A Bangladeshi farmer in polder 30 is concerned with the vigorous growth of high-yielding rice varieties because he believes it will make his land barren.

The low agricultural productivity is integrally related to poor water management, in particular, the lack of drainage systems during the rainy season.

Poor drainage system hinders cultivation of modern high-yielding, short-duration rice varieties. Also, the late harvest of traditional varieties in aman season and the lack of drainage before harvest prevent the cultivation of dry-season crops. Hence, the polder communities rely on a single crop of low-yielding rice varieties that further reduces food security in the entire coastal ecosystem.

Fortunately, opportunities are available for increasing food security in the polder zones through enhanced water and crop management. The use of stress-tolerant and early-maturing rice varieties followed by non-rice dry-season crops and the integration of aquaculture with rainy season rice could improve food production and household income. And for higher productivity to be realized, improved water management (primarily drainage) needs to be integrated. Improved drainage would enable early and timely establishment of traditional rabi crops (mostly sesame and mungbean). Cropping diversity increases the resilience of the farming system and greatly reduces the risk of damage or complete loss of crops from premonsoon rains and cyclones. ■

Dr. Yadav is an irrigated systems agronomist at IRRI.

SIIL: A new "Feed the Future" initiative

Limitted livelihood options, hunger, and malnutrition are some of the major problems that beset the polder communities in southern Bangladesh. The Feed the Future (FtF) Sustainable Intensification Innovation Lab (SIIL) is a new initiative that specifically responds to these challenges in these areas.

SIIL is a USAID-funded program that supports research, knowledge sharing, and capacity building in relation to smallholder farming systems, and increasing ecological intensification for the production of food, fiber, and other products in Asia and Africa.

In Bangladesh, SIIL has sub-awarded the project *Unlocking the production potential of polder communities in coastal Bangladesh through improved resource use efficiency and diversified cropping systems (short title: SIIL-Polder)*. The project is led by Kansas State University (KSU) and the International Rice Research Institute (IRRI), with partners including BRAC.

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Prof. Vara Prasad, SIIL director, discussed the program initiatives during the project's inception meeting in Bangladesh.

Also, SIIL is associated with the Geospatial and Farming Systems Research Consortium and the Appropriate Scale Mechanization Consortium to bring measurable impacts on reducing hunger, poverty, and improving the nutrition of smallholder farmers in Bangladesh. ■

SIIL-Polder project

The SIIL-Polder project aims to plan, evaluate, and support the adoption of practical farming approaches for the efficient use of available natural and human resources for improving food security, human nutrition, and livelihoods of rural polder communities in southern Bangladesh.

The project is led by Dr. Krishna Jagadish of Kansas State University

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The SIIL-Polder project team organized an inception meeting on 7 March 2016.

(KSU). Dr. Ignacio Ciampitti, an agronomist at KSU, will contribute to devising appropriate technological interventions, while Dr. Xiaomao Lin, an agricultural climatologist, KSU, will determine the vulnerability of the introduced technology under current and future scenarios.

IRRI, through Dr. Sudhir Yadav, is co-leading the project. Dr. Manoranjan Mondal, a water scientist at IRRI, will contribute knowledge and expertise on crop and water management and agronomy while Dr. Humnath Bhandari, an IRRI agricultural and environmental economist based in Bangladesh, will provide expertise in economic assessment of alternative and improved production interventions.

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Manorajan Mondal explains the water governance model in polders.

Dr. Sirajul Islam and his team from BRAC will play a key role in widespread sharing of effective technologies for the target region, community mobilization during field demonstration, and wider dissemination of key outputs.

Bringing change in polders through their communities

By Manoranjan Mondal and Sirajul Islam

Tens of millions of dollars are invested in improving the infrastructure of the polders each year. Despite the huge investment in water resources development, and the implementation of agricultural development projects by the government, nongovernment offices, and international organizations, productivity in the coastal zone remains low. Most farmers in this area still grow a single *aman* crop using low-yielding, late-maturing traditional rice varieties. Furthermore,

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Enhanced water and crop management can only be better achieved through a comprehensive community approach.

much of the land lies fallow several months each year; and where rabi crops are grown after the aman harvest, yields are less than 1 ton per hectare. Thus, the polders are home to millions of poor rural people whose livelihoods and food security depend primarily on agriculture.

The policymakers, water management and agricultural extension authorities, and the millions of farming families living inside polders believe that salinity and lack of fresh water for irrigation are the primary causes of the non-adoption of improved agricultural technologies in the coastal zone. But, over the past 50 years, there have been tremendous developments in agricultural technologies. Salt- and drought- tolerant crops varieties, and salinity management practices are available now.

But why is the coastal zone still deprived of these technological advancements? This is probably due to the failure in identifying the root cause of the non-adoption of Green Revolution technologies, and consequently low productivity which is poor water management, particularly the lack of drainage, which affects adoption of improved production.

How could the situation be changed and help the community to improve their food security? How can drainage and waterlogging be improved? The hydrology of the coastal zone is different from other parts of Bangladesh. High and low tides occur twice a day in the rivers of the coastal zone. During high tides, as the river water rises much higher than the land, huge volumes of water enter the polders through the sluice gates. In contrast, the water at low tide remains much lower than land elevation allowing gravity drainage. Thus, farmers cannot successfully modify their cropping system schedule and adopt improved agricultural technologies due to the prevailing hydrology in the polders of the coastal Bangladesh.

Using this hydrological advantage would be a key to encourage the adoption of improved production systems in the coastal zone of the country. Can an individual avail of this hydrological advantage? Is community coordination necessary to manage such huge water resources for productive use?

In fact, enhanced water and crop management can only be achieved through a comprehensive community approach. To address

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Drainage is critical for timely establishment of dry-season crops.

this, two community-based water management programs related to food security and enhanced livelihoods have been introduced in the polder area. Such programs have shared different advanced technology options related to farm mechanization although in small scale—as a research project. For instance, mechanized transplanting is found to be a cost-effective solution with opportunities to test different prototypes of transplanter. Hence, it creates more options for the farmers. Thus, more similar programs are needed to improve the entire ecological zone.

Enhanced water management can be facilitated by better use of existing ecosystem services such as strategic use of former river channels inside the polders to the adjacent tidal rivers, creating hydrologically defined water management units through separation of lands of different elevation, among other things. In short, it implies a better synchronization between water control and the tidal ecosystem. This can only be achieved, however, through a comprehensive partnership-based community approach. Since it is community-driven, the importance of partners at various stages cannot be undermined. National partners have an important role to play in carrying out such community-driven programs.

Higher productivity and improved livelihood cannot be achieved unless there is a novel approach to analyze the functions of polders, infrastructure inside the polders as well as special emphasis on drainage and a new water management framework. This is a long-term process aimed to generate profound shift in farmers' livelihood and can be achieved only through transformational changes. Promoting food security in the marginalized polder ecosystem through sustainable and equitable approaches is an opportunity to redefine the success of global agricultural research. ■

Dr. Mondal is a water scientist at IRRI. Dr. Islam is head of BRAC's Agriculture and Food Security Program.

Empowering women farmers in the polder communities of Bangladesh

By Humanth Bhandari, Anna Minj, Tahmina Begum, and Parul Sarker

Women constitute half of Bangladesh's 160 million human resources. About two-thirds (53 million) of them live in rural areas and eke out livelihoods from agriculture. More than half of the country's agricultural labor force are women. They are involved in all agricultural activities, although most common activities are postharvest operations, homestead production, and livestock and poultry raising.

With growing rural outmigration, women's role in agriculture is increasing. They contribute

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Understanding the household food preferences from women farmers in polders.

significantly to rural economy, and their empowerment is crucial to minimizing poverty and hunger.

Compared to men, women farmers face many obstacles. Empowering women farmers requires an understanding of their constraints and implementing targeted interventions for addressing these restrictions. These include land ownership and rights, access to improved varieties and technologies, extension and credit services, inputs such as seeds and fertilizers, farm machines and mechanization services, and knowledge and information. They also have limited decision-making power and participation in economic opportunities. These obstacles not only limit their productivity but also prevent women from achieving their full potential. As a result, women suffer more from poverty, food insecurity, and malnutrition.

Overcoming these obstacles, will provide alternatives to improve their livelihoods. Studies have shown that, compared to the men, women are more likely to spend their income providing better nutrition, education, and health for their families.

The SIIL-Polder project in Bangladesh emphasizes gender equality and women empowerment by reducing their workloads, raising agricultural productivity, increasing economic opportunities, and ensuring control over resources. These objectives could be achieved through many approaches, such as identifying women farmers' constraints and viable options for interventions; implementing interventions to enhance women farmers' access to technologies and services; training women on improved crop production, processing, and marketing skills; and establishing and nurturing women farmers' production and marketing groups.

Ensuring equal access to productive resources, and creating economic opportunities for rural women would boost agricultural productivity, and enhance their abilities to feed themselves and their families.

Through a community approach, women farmers can buy high-quality seeds and inputs at lower prices. Collective production, processing, and marketing will enable them to receive higher profit for their produce

because they will increase their access to different markets, reduce their transaction cost, and increase their bargaining power.

The project will leverage women's groups to educate rural women on improved farming and nutritious diets. Besides, the robust evidence generated by the project will help design women-inclusive programs and policies. By earning income, women will gain decision-making power and economic autonomy in the family, which will empower them. When women are empowered, their families, children, the next generation, and their communities are empowered, too. ■

Dr. Bhandari is an IRRI socioeconomist. Dr. Minj is the director of BRAC's Community Empowerment Program. Dr. Begum is the deputy director of the Department of Agricultural Extension in Bangladesh. Dr. Sarker is SIIL regional coordinator.

Mentoring the future generation: Looking beyond the bubble

By Krishna Jagadish

Agricultural students involved in research activities are constantly testing and fine-tuning new technologies. The improvements they have observed are shared with the public through research papers, posters, feature articles, or news items. Although they contribute to the advancement of knowledge, only a few of these can be applied to solving problems in the real world because their research objectives are defined by boundaries similar to a bubble. However, improving farming productivity is a far more complex undertaking and involves multiple interacting factors that almost always do not provide the right platform to integrate research conducted within artificial boundaries.

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Former IRRI scientist Liz Humphreys guides Nibir Saha for his PhD thesis.

Adaptive research is a concept that looks beyond the bubble. It allows opportunities for researchers with multiple disciplines to converge and address a complex challenge *in situ* to increase the probability of improving the situation on the ground.

One example of such dynamic and extremely complex scenario is in improving the socioeconomic conditions and the livelihoods of the

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IRRI scientists visit the experimental fields of Bangladeshi students.

farming community in the coastal regions, specifically the polder communities of Bangladesh. Using a large command area (around 600 hectares) as an experimental site, the project aims to involve MS and PhD students from disciplines including agronomy, social sciences, economics, climate-crop modeling, human and livestock nutrition, among other fields needed to respond to the challenging objectives set by geographic and environmental boundaries. The platform will bring in experts from the International Rice Research Institute, Kansas State University, BRAC, local extension officers, local universities in Bangladesh, and, most importantly, the farming community.

The overall goal is to gradually develop the local capacity and the skills for pragmatic sustainable interventions for improving their socioeconomic and nutritional status. ■

Dr. Jagadish is an associate professor in Kansas State University.

Advisory committee

The Advisory Committee of the SIIL-Polder project consists of representatives from different national institutes and the International Rice Research Institute. The committee reviews the workplan and progress of the project twice a year and provides directions to achieve the project's objectives. The members of the committee are:

Anna Minj is the director of Community Empowerment Program, Integrated Development Program and Targeting the Ultra Poor Program of BRAC. She obtained her MS in Zoology and completed her postgraduate diploma in Project Planning and Management from Manchester University, UK. She started her career at Caritas Bangladesh as a child care and orphanage management officer and became the coordinator of the Integrated Women's Development Program. She has worked at CARE Bangladesh as a gender advisor and head of Human Resource, Gender Equity and Diversity. She is affiliated with some national and international forums and networks in the field of development, gender, and indigenous people's right. She also serves as board member of several national and international development organizations and foundations.

Tahmina Begum is the deputy director of the Department of Agricultural Extension (DAE) of the Government of Bangladesh. She is the current project director of the Blue Gold-DAE project on water management in the southern region of Bangladesh. She received her PhD in Agriculture from the American World University and MS in Agricultural Extension from the University of Reading. She has more than 21 years' experience in tropical agriculture with special emphasis on dissemination of agricultural technologies especially in the coastal zone and char (riverine sand and silt landmasses) areas of Bangladesh, gender in agriculture, women in development, integrated pest management, and community empowerment.

Sultan Ahmed is the member director, Natural Resources Management Division of the Bangladesh Agricultural Research Council, the apex body of the national agricultural research system. He received his PhD in Mechanical Engineering (Renewable Energy) from the Bangladesh University of Engineering and Technology. He has more than 28 years' experience in farm machinery and water management research, policy formulation, monitoring, evaluation, research coordination, and resource allocation in agricultural mechanization in Bangladesh.

Mahfuzur Rahman is the additional director general for Planning at the Bangladesh Water Development Board (BWDB), the government organization responsible for policy formulation, development, and management of the water resources in Bangladesh. He received his Master of Engineering in Hydrology from the International Institute for Hydraulic and Environmental Engineering in Delft, the Netherlands. He has been working at BWDB for over 30 years. The organization is responsible for the construction and management of polders and polder infrastructure for improving agricultural production and livelihoods of the people living in the coastal zone of Bangladesh. He has vast experience in planning, designing, and implementing water resources development and management especially irrigation, drainage, river bank erosion, and flood control programs in Bangladesh.

Zahirul Haque Khan is the principal specialist and director of the Coast, Port, and Estuary Management Division at the Institute of Water Modeling. He received his MS in Water Resources Engineering from Bangladesh University of Engineering and Technology. Currently, he is involved in the Bangladesh Delta Plan 2100. He has 32 years' experience in integrated water resources management and planning and management of coastal water resources. He has vast experience in drainage and irrigation management, impact assessment of climate change and sea level rise on water resources and salinity intrusion, and hydrological and water flow modeling.

Manoranjan Mondal is a water scientist at IRRI and is the convener of the advisory committee. He has extensive knowledge of polder hydrology and natural resource management for increasing the productivity of rice and rice-based cropping systems. ■

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

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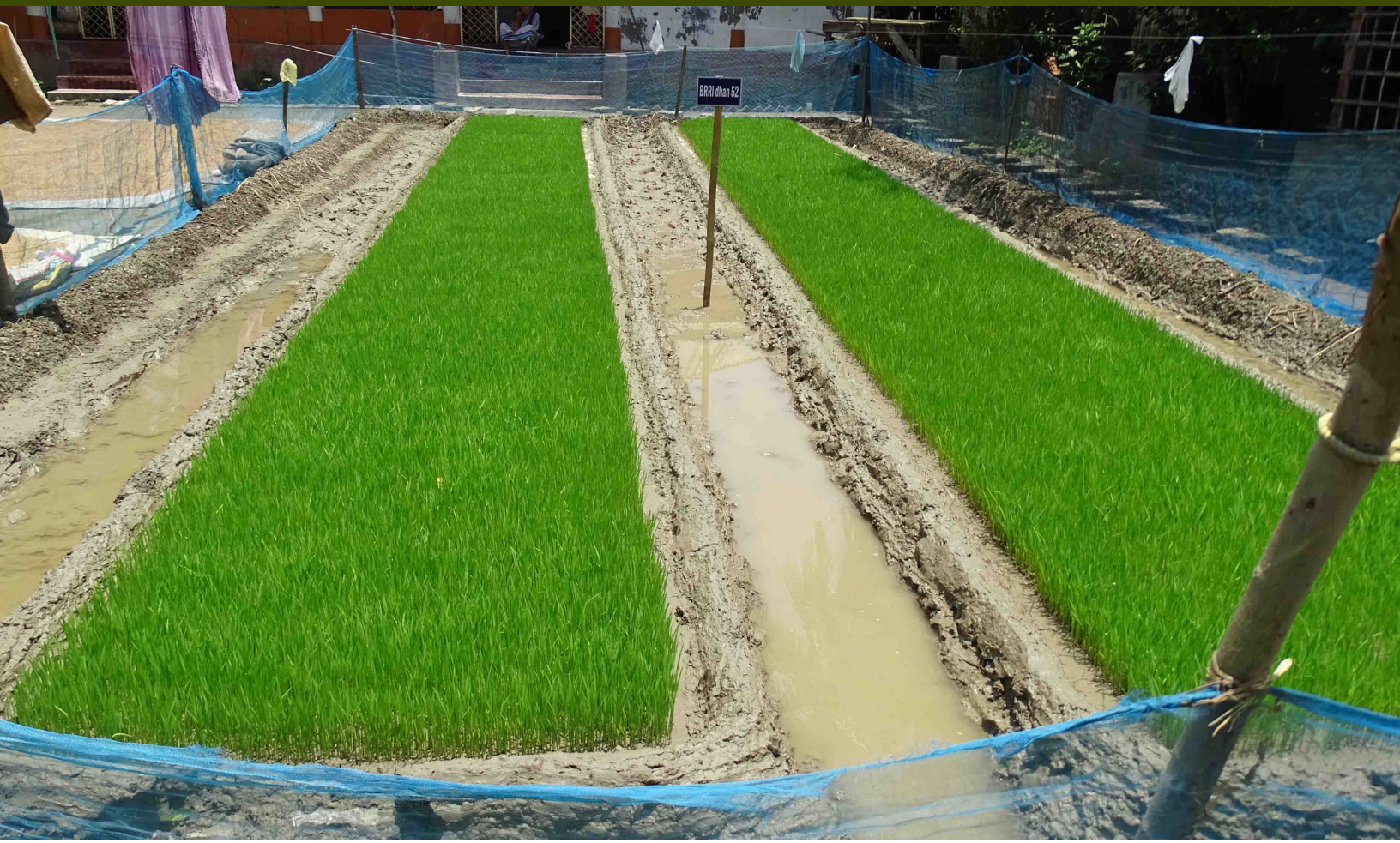

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