Better Rice for Asia's Poor

ADB is supporting an initiative to breed more nutritious rice to address the hidden hunger among millions in Asia

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Even small improvements in increasing the nutritional value of rice could have a substantial impact on the health of millions of Asians suffering from micronutrient malnutrition.

by Yassir Islam, HarvestPlus

FOR MILLIONS OF PEOPLE IN ASIA, rice is life. This is especially true for poorer Asians who depend upon rice for their survival. In rural Bangladesh, for example, rice provides up to 80% of the calories people consume. But while rice provides energy and some nutrients, it is no substitute for the better nutrition that a more diverse diet could provide. Most of the poor, however, survive on simple meals consisting mostly of rice, day in and day out. Fruits, vegetables, and meat (for those who consume it) are an occasional luxury, at best. As a result, millions of Asians suffer from micronutrient malnutrition.

Micronutrients, such as zinc, vitamin A and iron, are required by the body only in small amounts, but are essential to good health. Zinc, for example, is indispensable for a diverse range of biological functions; in fact, more than 100 specific enzymes require zinc to perform their catalytic role. Zinc is therefore critical in supporting physical growth and development, reproductive functions and preventing illness—or death—from common infections. Billions of people, especially in the developing world, are at risk from inadequate zinc intake. Asians are no exception. In Bangladesh, more than half the entire population is considered to be at risk from zinc deficiency, among the highest levels anywhere in Asia. That's more than 60 million people in Bangladesh alone. Cambodia, Sri Lanka, and Thailand follow closely behind, with more than 40% of their populations estimated to be at risk. The consequences of zinc deficiency can be devastating, particularly in young children who are especially vulnerable to disease and infections.

In Asia, even small improvements in increasing the nutritional value of rice could have a substantial impact on health in the region. In the 1990s, Howarth Bouis, a Research Fellow at the International Food Policy Research Institute believed that micronutrient malnutrition could be reduced through plant breeding by naturally improving the nutritional value of grains and tubers that undernourished people were eating. Recognizing the potential leverage of biofortified crops in improving human nutrition and welfare, ADB was an early supporter of research to determine whether such an approach, called biofortification, could work. Over time, ADB has contributed nearly $2 million to support proof of concept studies and the first human nutrition study of a biofortified crop, high iron rice. Promising evidence emerging from those early studies was instrumental in the creation of HarvestPlus, a challenge program of the Consultative Group on International Agricultural Research, in 2002.

Since then, as director of HarvestPlus, Howarth Bouis has coordinated a team of more than 100 scientific institutions and implementing agencies around the world to prove that breeding higher levels of nutrients into staple food crops such as rice, wheat, and maize, without detrimental effects on yield, disease resistance, or vigor, is possible. This has paved the way to breeding nutrient-dense, or biofortified, varieties of staple crops to deliver needed micronutrients to undernourished communities. It is envisioned that within a decade, the nutritional status of millions of poor people who depend on a few staples for their sustenance, especially in rural areas, will be improved.

ADB is continuing to partner with HarvestPlus during its next phase of activities in Asia: to develop, promote, and deliver biofortified rice for Bangladesh, the People's Republic of China, India, Indonesia, the Philippines, and Viet Nam, by the end of the decade. To meet this target, breeders both at International Rice Research Institute (IRRI) and at Bangladesh Rice Research Institute (BRRI), for example, are developing rice varieties with enhanced zinc content using conventional breeding strategies.

"We began by screening literally hundreds of varieties of rice germplasm in seed banks around the world," says Gerard Barry, the HarvestPlus Rice Crop Leader at IRRI. "We were able to find a few varieties with naturally occurring higher levels of zinc and, to a lesser extent, higher levels of iron."

Based on a series of trials during both wet and dry seasons in the Philippines, lead materials and candidate lines with high zinc content were identified. Next, advanced breeding lines were screened for actual zinc content in the rice grain and the most promising lines moved into crop improvement breeding programs. This research includes investing in laboratory facilities and building capacity in Bangladesh, which should accelerate breeding for high zinc rice and contribute to a better understanding of rice breeding in general.

IRRI and BRRI have successfully developed some early rice varieties with high zinc content. While these incipient varieties will undoubtedly be improved, what is needed now are human nutrition studies to determine the potential benefit to people at risk of zinc deficiency. In Bangladesh, community-based trials have indisputably demonstrated that supplemental zinc reduces the prevalence of morbidity and mortality among Bangladeshi children. The desperate need for additional zinc in their diets is clear. Can high zinc-rice have the

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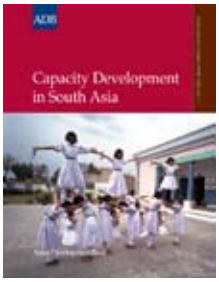

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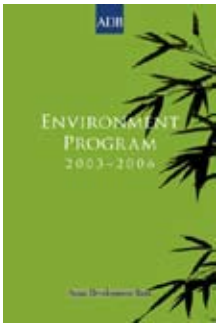

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same beneficial affect? The International Centre for Diarrheoa Disease Research of Bangladesh, which has worked to improve public health and nutrition for decades, is collaborating with the University of California at Davis and HarvestPlus to answer this question. ADB is also supporting these efforts by helping to establish a research program to develop and evaluate the nutritional benefits of zinc biofortified rice in Bangladesh.

As part of this program, scientists will conduct dietary intake studies to determine rice intakes and the adequacy of zinc intakes. They will also assess the zinc status among children under five years of age and women of reproductive age.

"We first need to know what people of different ages are eating," says Christine Hotz, Nutrition Coordinator for HarvestPlus. "This will enable us to select the appropriate age groups for a more intensive study on the impact of zinc biofortified rice on their nutritional status. Even though these new varieties of rice will have higher levels of zinc, like other nutrients, this can be lost during processing and cooking. We have to make sure that the rice that ends up on the plate and is eaten, actually improves zinc status. This should tell us whether we have bred sufficiently high levels of zinc to improve nutritional status into the crop."

Without such detailed evaluation, the nutritional benefits of high zinc rice can only be surmised. But once the evidence is convincing, and high zinc rice varieties are ready for dissemination, HarvestPlus will work with national agricultural research and extension services towards the registration and formal release of biofortified crops in target regions and to promote their widespread adoption. Baselines and postdissemination impact effectiveness surveys will also be conducted in target regions to determine the extent to which biofortified crops do improve human nutrition outside of experimental conditions.

The benefits of micronutrient-dense staple foods in Asia are only beginning to be explored, but with support from donors like ADB, the ramifications for improving human welfare are enormous. The cost-effectiveness of biofortification, alone, which should have low recurring costs once varieties are released, is attractive. Findings from the Bangladesh research program, coupled with progress in breeding, should result in micronutrient-rich rice varieties with desired agronomic traits that can be freely distributed to the poor to grow and consume, year after year. Until longer term strategies to raise incomes and increase dietary diversity trickle down, the poorest of undernourished Asians, who depend upon rice, will be able to improve their nutritional status by continuing to consume a food that they grow and know best.

See www.harvestplus.org for more information. ■