

Flood Tolerant Rice



By GIRIRAJ AGARWAL

Beginning of another green revolution?

Breakthrough research by three American agricultural scientists has given new hope to rice farmers in India and Bangladesh, where several million tons of rice are lost to flooding every year. The new rice varieties, one of which is being used in Uttar Pradesh and Orissa this season, can withstand water submergence for more than two weeks and the yield is much higher in comparison to varieties that have been popular until now.

The new varieties were developed by introducing a flood-resistant gene into normal rice varieties. Researchers introduced the gene from the low-yielding, submergence-tolerant FR13A variety found in Orissa to popular Indian varieties Swarna, IR64 and BR11. The U.S. Department of Agriculture honored the scientists involved in the research with the National Research Initiative Discovery Award in December 2008.

The scientists—Pamela Ronald of the University of California, Davis; Julia Bailey-Serres of the University of California, Riverside; and David J. Mackill of the International Rice Research Institute, Manila, who was earlier a researcher at University of California, Davis—received nearly \$1.45 million from the U.S. Department of Agriculture to work on this project since 1996.

“I knew that India and Bangladesh were the countries that had a lot of problems with submergence, so we used the varieties from these countries to start,” says Mackill, who had been working on flood tolerant rice since 1982. He discovered, with his graduate student, Kenong Xu, that an Indian variety had a flood tolerant gene. In 2006, the American scientists collaborated with the Central Rice Research Institute at Cuttack and Narendra Dev University of Agricultural Technology at Faizabad for evaluating the new varieties.

“They performed very well. Now, the variety Swarna Sub1 has been approved for release in Uttar Pradesh and Orissa, and seed production and dissemination is going on this season with strong support from the Indian government,” says Mackill. The new varieties were developed through precision breeding in which the new strain is genetically improved but not genetically modified.

How do the new varieties survive long periods under water? When submerged, rice plants do not get enough carbon dioxide and light, and photosynthesis gets disturbed. The plant tries to grow out of the water but in the process uses up its energy and dies. “Sub1 encodes a master regulator protein that coordinates important responses such as cessation of shoot growth. It also slows down other metabolic processes, which recommence when flooding is gone,” Ronald explains.

This breakthrough can bring huge gains to rice farmers of eastern India where rice crops are frequently destroyed by floods. “About 4.4 million hectares of rice cultivation area in

Julia Bailey-Serres during a trip to Orissa.

For more information:

Flood tolerant rice: A solution for India?

<http://asiasociety.org/business-economics/development/flood-tolerant-rice-a-solution-india>

USDA honors California researchers

http://www.csrees.usda.gov/newsroom/news/2008news/120511_discovery_award.html



PAMELA RONALD



Photographs courtesy IIRI

From far left: The popular Indian rice variety Swarna (left) and its genetically improved, flood tolerant version, Swarna Sub1; Asha Ram Pal, who used Swarna Sub1, at his submerged field in Faizabad, Uttar Pradesh; the same field, with lush crops, after three months.

India are highly flood prone. Another 16.1 million hectares are in the rain-fed lowland area. New varieties have the potential to usher in a second green revolution in India by enhancing productivity in Uttar Pradesh, Bihar, West Bengal, Orissa and Assam,” says Uma Shankar Singh, South Asia coordinator of the International Rice Research Institute project on stress tolerant rice. This project is funded by the Bill and Melinda Gates Foundation.

Singh and other scientists, under Mackill’s leadership, are also working to improve rice productivity in flood, drought and salinity prone areas. “This project started in March 2008 and

will continue for about 10 years. The first phase will end by October 2010,” says Singh. He is hopeful that this will increase rice productivity in India to an additional 23.5 million hectares in areas that are either saline or drought prone.

Ronald agrees that this is a big achievement in U.S.-India agricultural cooperation. “Four million tons of rice, enough to feed 30 million people, is lost to flooding each year in India and Bangladesh,” she says. She doesn’t see any problems in adoption of the new varieties by Indian farmers. “The variety is...available to the public.... There is no difference in quality. Under flooding though, the new variety yields three- to five-fold more.”

