Sub1 Rice News

A publication of the IRRI-Japan Project on Submergence-Tolerant Rice Varieties

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Responding to the needs of rice farmers in flash-flood-prone areas

Six major activities

Because of unprecedented typhoons and flooding in 2006 in several Southeast Asian countries, the Japanese Ministry of Foreign Affairs (MOFA) has supported the International Rice Research Institute (IRRI) project on "Implementation plans to disseminate submergence-tolerant rice varieties and associated new production practices to Southeast Asia." The project duration is from April 2007 to March 2009. The six countries participating in the project are Vietnam, Thailand, Laos, Cambodia, the Philippines, and Indonesia. Rice scientists from these countries convened on 14-15 June 2007 at IRRI and prepared country work plans that encompass six major activities:

1. **Loss and risk assessment.** Production damage from typhoons will be assessed, including areas likely to suffer damage and the magnitude in coming years. This will involve intensive consultations with scientists and officials from the six target countries, and applications of advanced geographic information systems (GIS) analysis combined with the latest government records of affected countries to quantify and project losses.

2. **Development of a response plan.** Based on current knowledge and inputs from Step 1, a comprehensive management plan will be developed. Since we already know the areas that were hit by the catastrophic 2006 typhoons, alleviation work can begin simultaneously with the assessment in Step 1. This response plan will involve (a) assessment and planning workshops to identify the areas most affected and likely to be affected by typhoons; (b) assessment of the varietal characteristics needed to meet the needs of farmers (because of different planting times and growing seasons across the target countries); (c) meetings with scientists, extension workers, and civil society organizations in affected countries to plan seed distribution and other adaptation activities to assure farmer acceptance of seed; (d) determining the quantity of seed required for distribution; (e) developing a seed multiplication plan for different varieties for different countries; (f) identifying the most likely partners to participate in the finalization of seed development and distribution; and (g) identifying the training needs of these partners for technology adaptation, evaluation, and dissemination. The evaluations in Step 1 will serve as an input for refining the management and response plan.

3. **Technology evaluation and adaptation.** Although varieties have already been developed that should be adapted to local conditions, it is still necessary to evaluate their performance to meet national varietal release requirements. As these varieties perform differently under flooded conditions than current varieties, comprehensive management practices must be developed so that farmers can fully benefit from them. This will involve (a) initiating testing programs for new varieties in various locations in all countries deemed to be susceptible to typhoon damage and flooding; (b) conducting comparisons of differing sources of submergence tolerance and combinations of sources to determine which are best suited for different typhoon-affected areas (different manifestations of typhoon impact, such as that from upland floodwaters, storm surge, and rivers overflowing their banks, and simple accumulation of water that does not drain in fields); (c) conducting field trials (on-farm and on-station) to refine best management practices for each location; and (d) obtaining feedback results from field and agronomic experiments in varietal development and gene identification programs.

Views of 117-day-old IR64-Sub1 and Samba Mahsuri-Sub1 after 17 days of submergence at IRRI.

4. **Training programs for extension workers and researchers in NARES**. The new technologies will require changes in management practices for farmers. Extension workers, as well as researchers, will have to be trained in these practices as well as in ways to communicate them effectively. This will involve (a) training in identification and evaluation of submergence tolerance in breeding lines, (b) training in assessing their performance under submerged and normal growing conditions, (c) training in conducting and evaluating trials in farmers' fields, and (d) training in communications to farmers on how to manage new varieties and seed for subsequent generations.

5. **Multiplication and distribution of new seeds.** To reach poor farmers currently suffering from submergence losses or likely to suffer losses in the future, adequate supplies of seed and conversion of additional varieties to submergence tolerance are urgently needed by (a) multiplying large quantities of seed of available varieties on the IRRI farm for immediate distribution, (b) distributing seed to target areas, and (c) establishing seed multiplication facilities in target areas for further multiplication.

6. **Follow-up study of the entire program.** This will have two components: (a) establishment of ex ante impact expectations and development of evaluation criteria, and (b) ex post assessment of delivery of seed to target areas and capacity-building efforts.

Development of submergence-tolerant rice varieties

Modern rice varieties are not adapted to flash-flood or submergence for up to 2 weeks during the growing season and this is probably why these varieties are not widely adopted and farmers still grow their local landraces with low yield. The *Sub1A* gene, derived from FR13A, a rice variety from Orissa, India, confers tolerance of 2 weeks of complete submergence. This gene can be introduced through marker-assisted backcrossing into popular varieties, providing some protection to farmers against short-term flooding. Varieties with the *Sub1A* gene have the same yield and other characteristics as the original variety, and they can be used to replace these varieties in submergence-prone areas. Seed multiplication of existing varieties and development of new *Sub1* varieties are now proceeding.

Key institutions and contact persons involved in the IRRI-Japan *Sub1* project

Key institution	Country	Contact person
Cambodian Agricultural Research & Development Institute	Cambodia	Dr. Men Sarom
Indonesian Center for Food Crops Research & Development	Indonesia	Dr. Suyamto Hardjosuwirjo
National Agriculture & Forestry Research Institute	Lao PDR	Dr. Mothathip Changpengxay
Philippine Rice Research Institute	Philippines	Dr. Leocadio S. Sebastian
Bureau of Rice Research & Development	Thailand	Dr. Samlee Bunyaviwat
Cuu Long Delta Rice Research Institute	South Vietnam	Dr. Le Van Banh
Agricultural Science Institute for Southern Coastal Central of Vietnam	Central Vietnam	Dr. Hoang Minh Tam
Food Crop Research Institute-Vietnam Academy of Agricultural Science	North Vietnam	Dr. Nguyen Tan Hinh

Currently available *Sub1* rice varieties

Name	Characteristics
IR64-Sub1 (IR07F102)	Days to flowering = 86 Maturity = 116 days Plant height = 95 cm Av yield = 5.9 t/ha
Swarna-Sub1 (IR05F102)	Days to flowering = 104 Maturity = 134 days Plant height = 85 cm Av yield = 5.3 t/ha
Samba Mahsuri-Sub1 (IR07F101)	Days to flowering = 98 Maturity = 126 days Plant height = 85 cm Av yield = 6.5 t/ha
TDK 1-Sub1 (IR07F289)	To be harvested at IRRI for characterization
BR11-Sub1 (IR07F290)	To be harvested at IRRI for characterization
CR1009-Sub1 (IR07F291)	To be harvested at IRRI for characterization

Source: A. Pamplona, 2007

Other submergence-tolerant rice varieties

Name	Characteristics
PSB RC68	Days to flowering = 98 Maturity = 121 days Plant height = 121 cm Av yield = 6.5 t/ha
IR49830-7-1-2-3	Days to flowering = 100 Maturity = 130 days Plant height = 110 cm

Source: A. Pamplona, 2007

Related news articles on *Sub1* rice varieties

Philippine Television GMA 7 News
The interview with Dr. David J. Mackill and Mr. Alvaro Pamplona from the PBGB Division of IRRI aired on 1 August 2007 on the evening news of Philippine local television network GMA7. The video can be accessed at its Web site:
www.gmanews.tv/video/9872/IRRI-develops-rice-that-grows-in-flood-or-drought

CNN News interview
The interview with Dr. Robert Zeigler, director general, and Dr. David J. Mackill, Program 1 leader of IRRI, aired on 17 October 2007. The video can be accessed at the CNN Web site:
http://edition.cnn.com/video/#/video/international/2007/10/17/rimintion.phillippines.invincible.rice.cnn

Time-lapse video
The *Sub1a* gene—identified by researchers at the International Rice Research Institute (IRRI) and University of California—enables rice to survive complete submergence for up to 17 days. Seeing is believing! To show the effect of the *Sub1a* gene, a time-lapse video recorded over the period of 14 June to 27 September 2007 on the IRRI farm was prepared by IRRI's photography and video section. For more information on this exciting work, go to www.irri.org/media/press/press.asp?id=138. The direct link to the video on YouTube is www.youtube.com/watch?v=apWCqcury90.

It was also featured by Science and Development News at its Web site: www.scidev.net/news/index.cfm?fuseaction=readnews&itemid=3975&language=1

Google News
Researchers at the Bangladesh Rice Research Institute say that a rice type, called Swarna Submergence 1, can survive flooding for up to two weeks. Normal rice varieties cannot survive being submerged by flood water for more than three days, resulting in huge losses for farmers. This rice type, called Swarna Sub1, developed by the International Rice Research Institute, proved to be flood resistant in trials conducted in northern Bangladesh.

Two articles were featured on 15 and 18 September 2007 in Google News titled **New rice strain "survives floods**" and **Bangladesh says new flood-resistant rice offers hope to farmers**.

Technical articles
Neeraja C, Maghirang-Rodriguez R, Pamplona A, Heuer S, Collard B, Septiningsih E, Vergara G, Sanchez D, Xu K, Ismail A, Mackill D. 2007. A marker-assisted backcross approach for developing submergence tolerant rice cultivars. Theor Appl Genet 115:767-776.

Submergence tolerance in rice requires *Sub1A*. In: Trends in Plant Science, Feb 2007, Vol. 12, No. 2.

Nontechnical articles
From genes to farmers' fields: the practical application of gene discovery to develop submergence-tolerant rice will help farmers avoid the ravages of severe flooding, by D.J. Mackill, **Rice Today**, Vol. 5, No. 4, p 28-30.

Identifying the submergence-tolerance gene, by S. Heuer, **Rice Today**, Vol. 5, No. 4, p 30-31.

The mechanics of submergence tolerance, by G. Vergara and A. Ismail, **Rice Today**, Vol. 5, No. 4, p 31.

NARES partners participated in Rice Breeding Course held at IRRI

NARES partners from the six collaborating Southeast Asian countries were sponsored by the IRRI-Japan project for the Rice Breeding Course held on 20-31 August and 1-12 October 2007 at IRRI. The first batch included Banthasak Vongphouthone (Lao PDR), Uraiwan Kotchasatit (Thailand), Hoang Duc Dung (S Vietnam), and Nenita Desamero (Philippines), while the second batch included Priatna Sasmita (Indonesia), Manivong Bounthieng and Duangsavath Lovanxay (Lao PDR), Jonathan Niones (Philippines), Peera Doungsoongnern (Thailand), Sy Tien Hoang (N. Vietnam), and Van Hiue Pham (C. Vietnam).

Special event
Dr. Dennis Araullo, assistant secretary for operations, and Dr. Silvino Tejada, director of the Bureau of Soils and Water Management of the Philippine Department of Agriculture, visited IRRI on 27 September 2007. They were given briefings regarding the rice project on submergence tolerance and were shown the demonstration plots. A stakeholders' forum on submergence-tolerant rice in the Philippines is tentatively scheduled for 16 January 2008 at IRRI. This will be sponsored by the Philippine Department of Agriculture.

Upcoming activities
5-6 November 2007: Planning Workshop on Socio-economic aspects of IRRI-Japan Sub1 Rice Project. Bangkok, Thailand.

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