PRESS RELEASE

Consultative Group on International Agricultural Research
World Bank, 1818 H St., NW, Washington, DC 20433

Contacts: Marshall Hoffman (office: 703-820-2244, home: 703-533-8482);
Sarwat Hussain (office: 202-473-5690, email: shussain@worldbank.org)

Embargoed for: Monday, May 17, 1999 at 4:00 p.m. EDT
Released in Washington, DC

New Rice Techniques Promise up to 25 Percent Less Water Usage

Ismail Serageldin, Chairman of CGIAR and World Bank Vice President for Special Programs, will be available for interviews in Washington, D.C. on Monday, May 17. Please call 703-820-2244 to schedule a time.

New, water-saving techniques are being developed that could save up to 25 percent of the water now used to grow rice, according to scientists of the Consultative Group on International Agricultural Research (CGIAR).

Such techniques are especially important for Asia, where demand for water is expected to increase sharply over the next 25 years -- more than 50 percent in Southeast Asia and India alone, and 40 percent in China -- and where about half of irrigated land is planted in rice.

"It takes twice as much water to produce rice than any other cereal crop – more than 2,000 tons of water is used to grow one ton of rice," says Ismail Serageldin, Chairman of CGIAR and World Bank Vice President for Special Programs. "With the projected growth of Asian cities and industries and their increased need for fresh water, rice farming must become more water efficient." Mr. Serageldin adds that "despite the constraints of water scarcity, rice production must rise dramatically over the next generation to meet the food needs of Asia's poor."

The new rice techniques include wet seeding, intermittent rice irrigation, land leveling, improved weed management, and management of cracked soils.

Announcement of the scientific developments comes on the eve of the CGIAR's mid-term meeting in Beijing, China, from May 24 - 28, 1999. The meeting will be hosted by the Government of the People's Republic of China. CGIAR members -- 58 industrial and developing countries, private foundations and regional and international organizations -- will be joined by scientists, agricultural researchers, and representatives of non-governmental organizations in discussing the impact of the CGIAR's future research agenda on pressing food security, poverty reduction, and environmental protection problems.

Rice is one of the most important grains in the world, but it is number one in Asia, the most populous continent. Many of the major rice-producing countries are developing nations categorized by the World Bank as "low income economies." In most of Asia, rice is not only the staple food, but also constitutes the major economic activity and a key source of employment and income for the rural population.

Asian farmers till about 90 percent of the world's harvested rice area and account for 90 percent of global rice production. In the majority of the Asian rice countries, rice occupies one-third or more of total planted area. Of the 25 major rice-producing nations, 17 of them are located in Asia, extending in a ***rice arc*** from Pakistan to Japan.

The link between water and rice is crucial, especially since fresh water is a scarce resource that is getting scarcer. Currently, 31 countries are facing water shortages, a number that is expected to increase to 48 countries by 2025, peaking at 55 countries by mid-century, 2050. The growing water shortage means there is a pressing need to devise methods of growing rice with less water, without any penalty to production. Many of the new techniques are aimed at reducing dependence on the traditional method of growing rice, in which farmers raise seedlings (young rice plants) in the seedbeds and then transplant the 25-30 day old seedlings in paddies that are kept flooded with about 2 to 7 centimeters (0.8 to about 3 inches) of standing water throughout the growing season. Water consumption for irrigated rice in most Asian countries is therefore very high.

More than half of the world's population will depend on rice as their principal food source in 30 years. Rice production must increase by more than 40 percent from the present production to avoid a rice shortage. But available land for cultivation is expected to decrease because of erosion, desertification, salinization, and rapidly increasing urbanization.

"With the accelerating loss of land available for rice cultivation due to urbanization, soil degradation and salinization, the problem becomes one of increasing yields under increasingly severe circumstances," says Ronald Cantrell, Director General of IRRI. "Saving water in rice-based irrigation systems needs particular attention because of the importance of rice to Asia. Therefore, CGIAR scientists are collaborating with farmers and national scientists to find ways to continue producing 'more rice with less water.'"

Two CGIAR research centers -- the International Rice Research Institute (IRRI), based in Manila, the Philippines, and the International Water Management Institute (IWMI), based in Colombo, Sri Lanka -- are leading the effort to research new water-saving techniques for cultivating rice in Asia, including:

Wet-seeding -- "Pre-germinated seeds" (soaked for 24 hours) are sown directly onto *puddled* (muddied) fields, rather than the traditional transplanting of young plants, 25-30 days old, in fields covered with water. Wet-seeding of rice uses about 20-25 percent less water than in traditional transplanted rice methods and drastically reduces labor for establishing the crop from 30-person days per ha for transplanting to 1-2 person days. When properly managed, grain yields of crops established by the wet seeding method will not be lower than what farmers get under the transplanted crop establishment.

Wet seeding is becoming popular in the irrigated areas of Thailand, Vietnam and the Philippines. For example, in an area of Central Luzon, considered the rice bowl of the Philippines, wet-seeded rice area increased from 8,000 hectares to 15,000 hectares in two years.

Farmers developed direct seeding methods over generations. Beginning in the 1980s, IRRI has worked with national rice programs to improve the process, as well as developing specialized equipment such as drum and slit seeders.

"Wet-seeding has been demonstrated to be a promising technology for meeting the water needs of rice. There will also be the subsequent need for changes in the management of nutrients and weeds for the full benefit of this technology to be achieved," says Mr. Cantrell.

Intermittent irrigation of rice -- Instead of keeping the fields flooded continuously, soil is irrigated, allowed to nearly dry out, then irrigated again, with the process repeated through harvest. In China, farmers have formed water users associations, which have pioneered water saving irrigation techniques aimed at reducing seepage and percolation from farms. The need for water-saving rice techniques is urgent in China, because per capita fresh water availability in China is among the lowest in Asia and still declining.

The most important advance has been the development of water saving irrigation techniques for rice, which applies intermittent irrigation to paddy fields instead of the traditional continuous submergence. Water is applied to the field and then stopped or suspended for a period until the soil is about to become dry, at which time irrigation is resumed..

Farmer groups of 30-70 members have been formed in China to facilitate improved irrigation management. Charging for this water is also based on the volume of water used by group. The water can cost about 5 to 10 percent of the profits they receive for their crops. The farmers therefore have a major incentive to adopt the new techniques.

IRRI and IWMI scientists are working in China to investigate how techniques at the farm level are transferable at the much wider water basin level and if the techniques can be transferred to other countries.

Land leveling -- Improved water management is the key to increasing rain-fed rice production in Cambodia, and later, to other parts of Asia. Land leveling is one new technique that offers potential for significant increases in the efficiency of water use, both directly and through the opportunities it provides for improved crop management. Many rice paddies are in fields of different levels, so that much more water is needed to cover the highest part of the field with the necessary water. The fields are leveled under this technique to one flat surface, which then needs much less water.

Uneven fields require more water to wet the soil for plowing, and to maintain complete water coverage for weed control. Insufficient water often results in uneven crop stands, uneven weed growth/infestation, uneven ripening and uneven yields within each field. More than 90 percent of Cambodia's rice fields in rainfed, lowland areas are uneven and would benefit from leveling.

The average unevenness (i.e., the average difference in height between the highest and lowest portions of the field) in Cambodian rice fields is 160 mm (6.2 inches) range, with some fields ranging between 70 mm and 330 mm of difference. Fields with the average difference in surface height need an extra 80-100 mm (3-3.5 inches) of water, or nearly 10 percent of the total water requirement to grow the crop, stored in the field to attain complete water coverage.

Land leveling contributes to better utilization of variable rainfall early in the season, reducing weeds and improving the timeliness of land preparation. Research by the Cambodia-IRRI-Australia Project has shown that large increases in rice yield when fields have been leveled and sound management practices adopted.

In a three-year test period, the average yield in leveled fields totaled 3.2 tons per hectare, versus 2.3 tons on uneven fields. In some trials, the yield more than doubled, from 2.3 tons per hectares to 5.4 tons.

One drawback is that the immediate costs of land leveling, using machinery, are high. The costs vary according to the topography, the shape of the field, and the equipment used, ranging from S3-S5 per 1 centimeter (0.39 inch) of soil moved per hectare. The cost is proportional to the amount of soil moved plus the fixed cost of machinery.

Once a field has been leveled, farmers must modify their plowing techniques to keep it level for at least 8-10 years.

Weed management in wet seeded rice -- One major reason farmers flood rice paddies is to suppress weeds that cut yield, especially at the beginning of the growing season when weeds present the greatest threat. If other weed control techniques, either by cultural, mechanical or chemical means, are used, the fields do not have to be flooded continuously.

IRRI scientists conducted experiments to confirm the hypothesis that improved water management practices during crop establishment (the first 2 weeks from planting) are crucial to enhancing the weed-suppressing advantages that can be achieved by early flooding of wet seeded rice. Such experiments also studied whether hypoxic tolerant genotypes (genotypes that can germinate well in oxygen-deficit conditions) would enhance the benefits of water management. The study confirmed that there were genotypic differences in seedling establishment and seedling growth in wet seeded rice under different water management techniques.

Management of cracked soils -- High water loss from rice fields during land preparation of soils for rice production results from bypass flow through cracks. Scientists believed that the losses could be reduced by measures that minimize crack development during the soil drying period, or by impeding the flow of water through these cracks. The effect of straw mulching and shallow surface tillage on crack formation during the fallow period, and reduced water needs during land preparation were promising on three sites in the Philippines.

Scientists conducted tests to determine whether the losses can be reduced by measures that minimize crack development during the soil drying period or that impede the flow of water through these cracks. These methods include straw mulching and shallow surface tillage on crack formation during the fallow period, and on managing the water flow components during land preparation.

In the control (i.e., no soil management treatment) plots, cracks did not completely close upon rewetting, resulting in high water loss (152mm-235 mm of water) during land preparation. Straw mulching helped conserve moisture in the soil profile, and reduced the size of cracks and the amount of water used in land preparation.

Dry shallow tillage formed soil crumbs which halted the continuous flow of water into cracks, reducing total water input for land preparation by 31-34 percent, equivalent to about 120 mm of water. The average surface irrigation water flow advanced faster and less time was needed for land preparation in the shallow tillage plots compared to the control.

The study demonstrated that shallow tillage offers a practical means for improving water-use efficiency of irrigation systems in rice growing areas. In rainfed areas, it may facilitate early crop establishment and thus reduce the risk of late-season drought.

The CGIAR

The **Consultative Group on International Agricultural Research** (CGIAR) is a global agricultural research network – the largest scientific partnership in this field. Established in the early 1970s, the CGIAR works to promote food security, poverty eradication and the sound management of natural resources in the developing world. It pursues these objectives through the diverse activities of 16 international agricultural research centers located throughout the world, and a small secretariat located in the World Bank in Washington, D.C.

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