



# PRESS RELEASE

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**Embargoed for: Sunday, October 27, 1996 at 4:00 p.m. Washington, DC**

*Ismail Serageldin, Chairman of the Consultative Group on International Agricultural Research (CGIAR), will be available for interviews on Thursday and Friday, October 24 & 25 by calling 703-820-2244.*

## **Agricultural Scientists Design Better Future**

**New Efforts to Feed People, Fight Poverty and Protect Environment in the 21st Century**

Despite some gloom and doom predictions, the world has the resources needed to feed the 8 billion plus people who will be on Earth in 2025, provided that appropriate policies are adopted and support for agricultural research is enhanced, says the Consultative Group on International Agricultural Research (CGIAR), the world's largest international research consortium.

CGIAR scientists are laying the foundation of a second global food production campaign that will exceed in scope the "Green Revolution" of the 1960s-70s, and be based on full partnership between top scientists and the poorest farmers around the world.

These scientists are developing new "super" rice, wheat and cassava strains and other crop varieties that can break through the yield ceiling, resist pests and thrive under heat, drought and on poor soils. Also, researchers are breeding new varieties of fish that double the returns to small farm aquaculture, and are finding ways for milch animals to also serve as draft animals. To achieve the breakthroughs needed for the future, CGIAR is now working through a new coalition that combines the best of international science with national research and traditional knowledge of farmers.

Since the founding of CGIAR in 1971, research has led to food increases sufficient to feed one billion more people. Production of 10 major developing country food crops increased by 74 percent since the early 1970s. Yield advances from improved technology contributed 70 percent to this growth in food output.

"Increased yields alone will not be enough to adequately feed everyone 30 years from now," says Ismail Serageldin, chairman of CGIAR and World Bank Vice President for Environmentally Sustainable

Development. "The incomes of the poor must be increased, the policy framework must be right, and above all the research must be responsive to real needs. The best research in the world means little if farmers do not find the results practical, too expensive or not fitting in with their needs."

The world community has defined three interlocking goals for agriculture in the future -- achieving food security for all; ending global poverty; and protecting the environment -- which go beyond the main goal of the Green Revolution, which focused on increasing crop yields.

"That's why CGIAR is seeking a revolution in how agricultural research and technology is used in order to meet this triple challenge," says Mr. Serageldin. "We must bring the best cutting edge science, the highest technology to bear on the problems of the poorest farmers who work on just one to three acres of land."

To this end, CGIAR is hosting a global forum in Washington, D.C., October 29th-30th, in which all parties active in research will meet to find solutions and strengthen cooperation -- scientists, farmers, the private sector, non-governmental organizations, governments and international organizations such the World Bank.

"This is the first time ever that all participants in rural development, especially representatives of the farmers associations themselves, will be assembled in one place to coordinate policies," says Mr. Serageldin. "The goal is to create a global agricultural research system, of which the CGIAR will be a very central piece, that will bring practical but dramatic changes to small farmers around the world."

Mr. Serageldin adds that a "new synergy" must be formed. The scientific community needs to listen and learn from farmers because they have centuries of knowledge about what works best on their land. The CGIAR will focus its best scientific efforts on the problems identified by farmers, including the integration of farm production and natural resource management.

CGIAR is focusing its science specifically at analyzing and improving the complex small holder farming systems of the developing world. Integral to this research thrust will be:

- Maintaining and improving crop yields -- A "super" cassava, for Africa has recently been developed. It can increase yields of this basic food crop from the current 2.4 tons per acre to up to 28 tons per acre;
- Hardier crops to stabilize yields -- Varieties that resist pests and diseases without the need for costly and hazardous pesticides, and better tolerate poor soils, polluted water, drought, cold and heat;
- Water management -- For example, technology that will show farmers how to create ponds that will allow them to farm fish for family consumption and commercial sale, but which can also store water for use during droughts;
- Agroforestry -- To develop new trees and new systems that will allow farmers to grow trees

commercially, which will also protect tropical forests from development, as well as adding millions of trees to the global environment;

- Livestock -- To improve health and increase productivity of small holder livestock, especially in Africa;
- Land and water management -- CGIAR has a new research initiative which aims to develop joint management of land, water and soil nutrient resources.

The first Green Revolution has produced significant results. However, for the next 30 years, the rural poor will continue to constitute the majority of the world's impoverished; it is only by raising the vast rural areas out of poverty that the global problem can be overcome. The work that started with the Green Revolution must therefore continue.

From the early 1970s to 1994, farmers and researchers in the developing world with the CGIAR's help, have increased yields in these food crops:

- Rice, to 3.6 metric tons per hectare (2.47 acres), a 56 percent increase;
- Wheat, to 2.6 metric tons per hectare, a 116.6 percent increase;
- Maize (corn), to 2.7 metric tons per hectare, an 80 percent increase;
- Potatoes, to 13.5 metric tons per hectare, a 34 percent increase;
- Food legumes, to 0.7 metric ton per hectare, a 17 percent increase;
- Cassava, to 9.9 metric tons per hectare, a 14.3 percent increase;
- Yams, to 10.3 metric tons per hectare, a 30.4 percent increase;
- Bananas, to 12.8 metric tons per hectare, a 28 percent increase;
- Barley, to 1.2 metric tons per hectare, a 17 percent increase;
- Millet, to 0.7 metric ton per hectare, a 5.7 percent increase;
- Sorghum, to 1 metric tons per hectare, a 13 percent increase;
- Sweet potato, to 13.2 metric tons per hectare, a 16.8 percent increase.

### **Value of Research**

For success, both now and in the future, agricultural research at national and international levels must be increased. Study after study shows the enormous benefits achievable from agricultural research, including CGIAR research. Some examples of the high annual rate of return are:

- 65 percent for rice research in India and Indonesia
- 22-42 percent for research on potatoes in Peru
- 50 percent for wheat research in all developing countries
- 190 percent for maize research in South America

Despite growing recognition of agriculture's central role in development, the share of the agricultural product going to research is declining in many poor countries. This trend is also accompanied by a drop in official development assistance (ODA) going to agriculture generally, whose share of ODA has decreased from 20 percent in 1980 to 14 percent in 1990.

Support for international agricultural research accounts for less than .05 percent of ODA. Currently, CGIAR spends \$300 million per year, about 4 percent of total agricultural research expenditure in and for developing countries.

"Further drops in spending on agricultural development generally, and research specifically, can hurt food security, the environment, and the very survival of hundreds of millions of families in the developing world," says Mr. Serageldin. "Historically, agriculture has been the engine of economic growth. It accounts for 60-80 percent of employment and one-third of the national income in many poor countries."

By 2020, wealthy countries and rapidly growing developing countries will have either food surpluses or sufficient ability to import food, while poor, slow growing countries will make little or no progress toward food security or in reducing malnutrition.

CGIAR research is therefore aimed at improving farming and the diets in poor developing countries, but its research has also paid significant dividends in more advanced developing countries and industrialized nations, which benefit from improved plant germplasm. Some of the world-changing research going on in CGIAR includes:

- **Wheat** -- If current trends continue, wheat will become the consumer's preferred grain in developing countries, just as it is in industrialized nations. CGIAR researchers have been able to modify wheat, once mostly restricted to temperate and subtropical zones, to make it productive even in warmer climates. Some 75 percent of all spring bread wheat varieties now grown in developing countries (not counting China) are either crosses developed by the International Maize and Wheat Improvement Center (CIMMYT), a CGIAR center based outside Mexico City, and ICARDA, the International Center for Agricultural Research in the Dry Areas, based in Syria.

Since the early 1970s, average wheat yields in developing countries have doubled from 0.5 ton per acre (1.2 tons per hectare) to 1 ton per acre (2.46 tons per hectare), the fastest productivity growth of any basic food crop. In the last two decades, 80 percent of the additional wheat output of the developing world has come from yield increases; only 20 percent came from more land planted. In 1995, the developing countries produced 43 percent of the global wheat harvest, the highest share ever.

CIMMYT researchers are also transferring genes from wild grass varieties of wheat relatives into elite bread wheat varieties in order to bring additional diversity that will protect the plant against disease and stress.

- **Corn (Maize)** -- Corn production in developing countries is also rapidly expanding. Yields rose 80

percent since 1970, and the developing countries now account for 47 percent of the global corn harvest. Corn farmers in the developing world face many problems, including drought, which threatens half of the 149 million acres (60 million hectares) planted in corn. In 1993, drought in the developing world caused the loss of some 24 million tons of corn, or 15 percent of potential harvest.

Now, CIMMYT has managed to produce a drought-tolerant strain that yield one-third more corn under drought conditions, at no cost to yields when rain is plentiful. It is estimated that this new corn, once widely distributed, will lift yields worldwide by as much as a third.

- **Rice** -- A new breed of "super rice" that could produce 25 percent more grain on the same amount of land and help feed an additional 450 million people is being developed by scientists at the International Rice Research Institute (IRRI).

Rice specialists believe that this new rice could go a long way toward meeting the food needs of the world throughout the next century, especially in Asia where rice is the main staple.

Mechanization can increase efficiency greatly, but low cost innovations are needed for developing countries. Care has been taken that new technologies do not displace labor, but in fact increase the returns to the labor of the poor, creating more income and jobs. Recently, engineers at the International Rice Research Institute (IRRI) have developed a mini-machine for taking the bran (brown shell) off rice, which reduces the extreme drudgery of hand milling.

IRRI has also developed a new rice harvester, a gasoline-powered device that looks like an oversized lawn mower. The harvester is being introduced to smallholders across Africa and Asia. It gathers rice grain more cheaply and efficiently than other harvesters because it merely combs the seeds off without cutting the stalks. The new machine is designed to work on fields of less than 1.2 acres (.5 hectares), and is capable of harvesting 4 tons of rice per day. Its true value is that it leaves 90 percent of rice plants rooted in the field, for a "ratoon" crop in the next growing season. Previously, farmers cut down these stalks and burned them, which meant they had to plant new seedlings by hand.

- **Beans** -- The developing countries produce 70 percent of the world harvests of food legumes (pulses), of which beans are an important protein-rich crop in Latin America and Africa. The Bean Program at the International Center for Tropical Agriculture (CIAT) in Cali, Colombia is seeking to help bean farmers in developing countries, as well as in the United States.

The U.S. bean crop (Some 1.9 million acres are planted in beans across 17 states) depends heavily on germplasm susceptible to white mold and root rot, two major diseases of the crop in temperate environments. U.S. scientists hope to overcome these and other problems by introducing tropical

germplasm with an upright plant type into their breeding programs, which they are pursuing through various forms of cooperation with CIAT.

- **Potatoes** -- Because of a series of new scientific breakthroughs in potato production, farmers in the near future should be able to harvest bountiful crops of a hybrid potato from a few grams of seeds (true potato seed) sown directly into the soil, allowing harvesting only 100 days after planting, rather than the current system of planting potato tubers from the previous year's crop, which take 150 days to reach harvest size.

CGIAR researchers have improved the potatoes native to high, cool climates, that grow in warm climates so much that it is believed to be growing faster than any other food crop in both Asia and Africa. In both China and India, the world's most populous nations, potatoes are now planted as a second crop after rice. In the past decade, India's potato crop has quadrupled, and China's has tripled. Today, only Russia produces more potatoes than China.

"The potential of potato cultivation has barely been touched in developing countries," says the International Potato Center (CIP). "Farmers in developing countries can harvest potatoes within 60 days of planting, about a third of the time needed in temperate climates."

To assist potato breeders, researchers at CIP (based in Lima, Peru) and Louisiana State University are introducing "synthetic genes" directly into the potato cell. Researchers are particularly eager to introduce genetic resistance to bacterial diseases into the potato, because that is a trait rarely found among wild potatoes. The ability to withstand bacteria is especially important in transforming the potato into a crop for the true tropics, where heat and high humidity increase the chances of contracting infections.

- **Cassava** -- Widespread planting of the "super cassava," a tuber vital in the diet of 200 million Africans, could greatly improve diets in that continent and form a buffer against hunger caused by drought. Up to now, farmers in Africa have produced about 2.4 tons per acre (6 tons per hectare) with regular cassava, while super cassava yields have been as high as 28 tons per acre (70 tons per hectare).

- **Mineral-enriched crops** -- CGIAR centers have launched The CGIAR Micronutrients Project to develop new mineral-enriched varieties of the developing world's most common food crops. CGIAR is working with institutions in Australia, the United States and several developing nations to develop new varieties of corn (maize), rice, wheat, bean and cassava that will be better at absorbing critical minerals directly from the soil than the current varieties are.

More than 2 billion people do not get sufficient amounts of iron and other minerals in their diets. A lack of iron contributes to anemia, which affects some 1.2 billion people. As estimated 225 million children suffer

from severe vitamin A deficiency which in 28 percent of cases is lethal. Zinc deficiency is widespread and closely associated with iron deficiency.

The project hopes to have nutrient-enriched varieties ready for commercial production within six to ten years. The project's impact could be enormous, since a relatively modest increase in the micronutrient content of plants could have a big impact on nutrient deficiencies in humans.

- **Livestock** -- Livestock animals are a key to unlocking economic development because they provide a financial safety net for the poor in countries lacking public assistance and welfare programs.

One example of how research can improve the income and wealth of poor farmers comes from Africa. The International Livestock Research Institute (ILRI), operating out of both Nairobi, Kenya, and Addis Ababa, Ethiopia, has shown that crossbred dairy cows which exist in Ethiopia, can also pull plows. The local zebu/Holstein cows weigh 770 pounds (350 kilograms) versus 550 pounds (250 kilos) for local oxen.

Demonstration projects with the crossbreds have been a success: the extra size made the cows more powerful, allowing them to handle a full workload without a substantial reduction in milk or calves. Scientists in eastern and southern Africa are now interested in testing the technology.

- **Fish** -- CGIAR researchers have already developed the first generations of a "super-strain" of tilapia farm fish with a flavor that is equal to the best free-running freshwater or marine fish, growing 60 percent faster than present farm breeds and having a 50 percent better survival rate. More than a billion people in developing countries depend upon fish as their primary source of quality protein. With fish production stagnant at 100 million tons per year, the next great leap in producing aquatic food will come in developing countries from domesticated and genetically improved varieties of fish and other seafood. Developing countries already now account for 60 percent of world fisheries production. In 1971-1975, their share in global fisheries output had been 42 percent.

- **Agroforestry** -- The International Centre for Research in Agroforestry (ICRAF), based in Nairobi, Kenya, is promoting the integration of trees, mainly fruit trees, into farming --- agroforestry -- in order to reduce the pressure on forests by providing farmers with a nearby, convenient source of food, fuelwood and timber.

ICRAF is seeking to improve products from the vast and largely untapped genetic wealth of trees found in tropical forests and woodlands. Tropical tree products include fruits, nuts, oils, resins, medicines, cosmetics, fibers, fodder and dyes -- as well as timber and fuelwood.

ICRAF is focusing on 'Cinderella trees', so called because they have been overlooked by researchers and international markets despite their great potential. By using simple, low-tech horticultural techniques to

select for traits that farmers and markets find desirable -- larger fruits, lower crowns, better quality nuts or oils -- ICRAF researchers are encouraging farmers to grow trees on their farms.

## **Acid Soils**

Twenty years ago, soil scientists considered acid soils practically useless for crop production. Acid soils are characterized by toxic levels of aluminum, limited availability of nutrients essential for plant growth, and high susceptibility to wind and water erosion.

CGIAR, however, has found that it unrealistic to write acid soils off, because they are extremely widespread in the tropics, covering 51 percent of the land in Latin America, 38 percent in Asia and 27 percent in Africa. Under increasing population pressure, acid soils are now rapidly being brought into cultivation, generally with dire ecological consequences.

Modifying acid soils through heavy liming and fertilizer application is too expensive, so that genetic improvement provides farmers an inexpensive alternative. The CGIAR research center CIAT has centered its germplasm research on acid soils.

By the late 1970s, CIAT researchers had learned that replacing native vegetation on acid savanna soils with more productive, introduced grasses and legumes could increase livestock production from just one herd of cattle on 25 acres (10 hectares), to about two per five acres (two hectares). By the end of the 1980s, CIAT scientists had also developed upland rice lines with high levels of tolerance to acid soil conditions.

The improved germplasm permits the development of agro-pastoral systems that integrate food crops with highly productive but environmentally friendly combinations of tropical grasses and legumes, such as rice pasture and corn pasture rotations.

Nearly 20 million acres (8 million hectares) of corn (maize) is planted in acidic soils. Normal corn begins to have trouble in soils of pH5 or lower. Excess aluminum shrivels corn roots and renders them unable to absorb water and nutrients.

Recently, CIMMYT has developed six varieties of corn that can withstand acidic soils much better than any variety grown today. They are expected to increase yields by one-half ton per hectare, a rise of 40 percent.

"Development of genetically acid-soil tolerant maize varieties offers an ecologically clean, energy-conserving and cost-effective way to increase corn yields in these areas," says CIMMYT. "It would permit sustainable corn cropping systems to be established in acidic savanna and ease the pressure to cut down

tropical rain forests to obtain additional farmland."

### **Integrated Pest Management**

Many CGIAR research programs are aimed at cutting the use of pesticides and fertilizers, as a way of cutting costs for poor farmers as well as protecting the environment and eliminating health hazards for both farmers and consumers. Integrated pest management (IPM) in rice is one example can greatly reduce the need for chemical pesticides.

The Green Revolution of the 1960s-70s resulted in an unprecedented leap in rice production, but intensified rice production has also exacerbated pest problems.

As a result of active promotion of insecticide use by industry and government subsidy schemes, farmers became accustomed to applying insecticides at regular intervals. A recent analysis of insecticide used on rice by IRRI scientists showed that as much as 80 percent of insecticide sprays that farmers use were unnecessary.

In Long An Province, Vietnam, the use of print and broadcast media to encourage farmers to test halting insecticide use was tried. About 70 percent of the farmers who heard the broadcast tested the simple use and then stopped early insecticide use for leaf-folder control.

The fundamental strategy in IRRI's Integrated Pest Management (IPM) projects is to maximize naturally occurring resources for biological control. Most insect pests of rice depend on rice for their development, while many predators are generalists. While pest species have short life cycles and are highly mobile, most predators have long life cycles and are less mobile. For predators to survive through the non-crop period, the perennial habitats surrounding rice become important refuge areas. Predator biodiversity in rice ecosystems is dependent on habitat and vegetation biodiversity. To conserve natural biological control, strategies to conserve biodiversity in rice ecosystems are being developed.

Fungicide use in rice has remained low. One reason is that host plant resistance remains an effective and economical way to control diseases. Today, modern cultivators have resistance to blast, bacterial leaf blight, grassy stunt, and tungro.

IRRI's ultimate objective in promoting IPM is to improve farmers' decision-making ability in pest management. IRRI, together with national agricultural research institutions, is therefore not only seeking a better understanding of the biological elements that contribute to pest problems, but also conducting research to understand the decision-making process of farmers and trying to find ways to communicate scientific knowledge more efficiently to farmers.

## **Water Harvesting**

CGIAR scientists are working on agricultural water harvesting techniques, which are based on capturing the runoff from downpours or night condensation and using it to increase the availability of water to crops.

The key factor in the success of any water harvesting system is the proper selection of the site and appropriate methods to be used. ICARDA is working with the University of Karlsruhe in Germany and the General Organization for Remote Sensing in Syria to use satellite images to identify potential areas and suitable methods of water harvesting in central Syria.

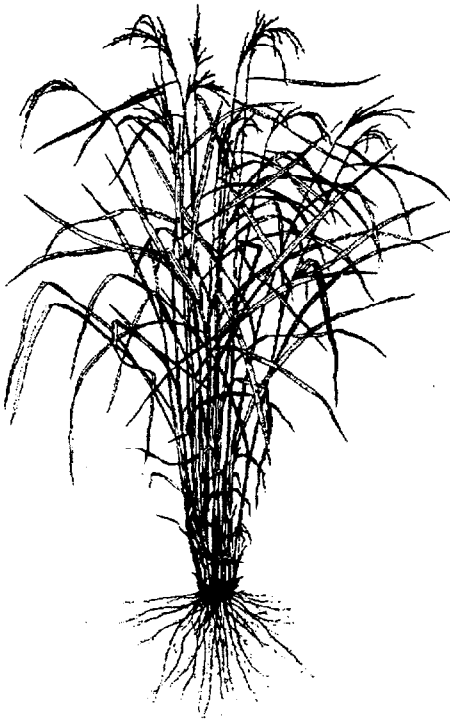
Studies at the University of Karlsruhe disclosed that remote sensing, used together with Geographic Information Systems (GIS) is much more efficient for investigating areas with limited information and infrastructure.

## **The CGIAR**

The CGIAR is an informal association of 52 governments of industrialized and developing countries, international organizations, and private foundations supporting an international research system for agriculture, forestry, fisheries and management of natural resources in developing countries. Its goal is to contribute, through research, to sustainable agriculture for food security in the developing countries.

The World Bank, the Food and Agriculture Organization (FAO), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP) jointly sponsor the CGIAR, which maintains 16 international research centers with a consolidated budget of \$300 million, some 880 senior scientists and a total staff of 10,378. In 1996, CGIAR celebrates the 25th anniversary of its establishment in 1971.

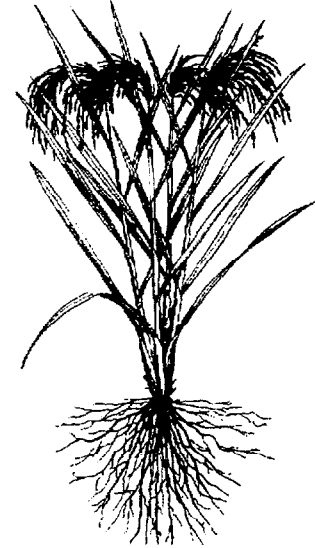
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Tall Conventional Plant



Improved High Yielding  
(Modern Rice)



Low Tillering Ideotype  
(Super Rice)

**Year:** Before 1968

**Height:** 110-180 cm  
**Leaves:** Thin, long, small, drooping  
**Tillers:** High tillering

**Panicles:** Less than 10  
**Growth Duration:** 140-180 days  
**Grain yield Potential:** 1.5-3.5 (4.0) T/HA\*\*

**1970s and 80s\***

**Height:** 90-110 cm  
**Leaves:** Thin, short, small, erect  
**Tillers:** High tillering (up to 25 each plant)

**Panicles:** Up to 15  
**Growth Duration:** 110-140 days  
**Grain yield Potential:** 6-10 T/HA\*\*

**21st Century**

**Height:** 90-110 cm  
**Leaves:** Thick, short, erect  
**Tillers:** Up to 15, but no unproduction ones

**Panicles:** Up to 8  
**Growth Duration:** 100-130 days  
**Grain yield Potential:** 13T/HA\*\*

\* - Of development and introduction to farmers' fields

\*\* - T/HA =Tons per hectare (2.47 acres per hectare)



Cassava



Wheat  
Modern semidwarf variety