



THE CGIAR AT THE **Forefront of Science**

The CGIAR leads the way in several essential areas of agricultural science

INFORMING BETTER SOIL HEALTH IN AFRICA

Sub-Saharan Africa's soils are among the poorest in the world, with 500 million hectares of the region's farmland moderately or severely degraded, chronically depressing yields. The Consultative Group on International Agricultural Research (CGIAR) is working on a new effort to develop a digital map called the African Soil Information Service (AfsIS) that covers all 42 countries in the region. The project combines the latest soil science and technology with remote satellite imagery and on-the-ground analysis of thousands of soil samples from across the continent. This information is critical to identifying the types and amounts of mineral and organic nutrients needed to improve crop yields. Data provided by AfsIS regionally, nationally and locally will help poor farmers and agricultural experts identify the best options for sustainably improving crop production in Africa through better soil management.

CLIMATE CHANGE, AGRICULTURE AND FOOD SECURITY

The recently launched CGIAR Challenge Program on Climate Change, Agriculture and Food Security provides stakeholders with knowledge and tools to identify climate threats and assemble integrated strategies for coping with them based on sound technological, policy and institutional options. Other forward-looking CGIAR initiatives research climate change in regard to fisheries, forests and water productivity.

■ **Fisheries and Climate Change**

With climate change threatening to ruin ocean reefs, push salt water into freshwater habitats and produce more coastal storms, millions of people in fishery-dependent nations of Africa, Asia and South America could face unprecedented hardship. Research by the CGIAR and its partners has identified nations that are

highly vulnerable to climate change because of high fishery susceptibility and importance and low national coping capacity. This work informs both (1) initiatives aiming to predict with greater precision the impact of climate change on fish-dependent populations and (2) governments and international institutions about where to focus fishery adaptation efforts.

■ **Forests and Climate Change**

Forest loss and degradation account for up to one fifth of anthropogenic greenhouse gas emissions, making reduced emissions from avoided deforestation and forest degradation (REDD) a highly cost-effective mitigation measure. CGIAR research on the role of forests in mitigating climate change is helping to shape the global debate on REDD mechanisms in the post-2012 climate regime by offering options for managing such complex issues as benchmarking and monitoring forest carbon and the rights of forest-dwelling communities.

■ **Water and Climate Change**

Climate change will put greater pressure on water resources, as increasingly erratic rainfall patterns force farmers to rely more heavily on irrigation. CGIAR research points to a range of technologies and policy measures that can improve water productivity in irrigated and rainfed agricultural systems alike, including those that incorporate livestock and fish. Key recommendations include drip irrigation, water harvesting and shared ownership of water resources.

HOW TO DOUBLE RICE YIELDS

Rice is the staple food of half of the world's population. Mounting pressures on natural resources and the expected 50% expansion of the world's population in the next half century make boosting the productivity of rice crucial to



ensuring long-term food security. The CGIAR leads a global consortium of scientists in an ambitious project to re-engineer photosynthesis in rice to produce 50% more grain using less fertilizer and water. Plant species use solar energy in different ways to capture carbon dioxide and convert it into the carbohydrates required for growth. Rice is among those that use relatively inefficient C3 photosynthesis, while maize and sorghum have evolved much more efficient C4 photosynthesis. Converting rice from C3 to C4 is expected to boost yields by half and double water-use efficiency.

THE RACE AGAINST WHEAT RUST

A new form of wheat stem rust first seen in Uganda in 1999 and known as Ug99 can slash wheat yields by 20-80%. It is now present in Uganda, Kenya, Ethiopia, Sudan, Yemen and Iran and on the march to South Asia. Only 10% of wheat varieties in farmers' fields around the world resist Ug99. CGIAR scientists and partners have achieved a breakthrough in developing new wheat varieties that not only resist Ug99 but also produce more grain than today's most popular varieties. An intensive shuttle-breeding program has produced new types of high-yielding wheat with Ug99-resistance traits derived from multiple minor genes. Scientists believe that forcing the fungus to overcome an array of genetic barriers will protect these new wheat varieties from future stem rust mutations over the long term. As global communities rush to adopt these new wheat varieties widely, Ug99 infestation will come under close surveillance across 29 countries through a system hosted by the Food and Agriculture Organization of the United Nations that uses global positioning systems to provide timely information to decision-makers.

AVERTING A FUTURE FOOD CRISIS

The 2008 food crisis pushed millions deeper into poverty and hunger. Today, a weakened global economy, market volatility and high food prices threaten to further damage livelihoods that are already fragile. Renewed global attention to agriculture and calls to increase investments in agricultural research position the CGIAR to help shape the global response and ensure that a food crisis does not recur, while improving global food security, especially for the poor. To better target research investments, CGIAR scientists and

partners conducted an impact assessment to determine where and how to focus new investments to achieve maximum benefits. The resulting 14 best bets range in cost from US\$10 million to \$150 million over 5 years and include boosting yield growth in the intensive cereal systems of Asia and providing more drought-tolerant maize to Africa. Collectively, these options can liberate hundreds of millions of people from dollar-a-day poverty over the next 10 years through well-focused and well-funded research.

GENEBANKS FOR AGRICULTURE'S CROWN JEWELS

Eleven CGIAR Centers run genebanks containing over 650,000 accessions of some 3,000 staple crop, forage and agroforestry species essential to human food security and nutrition. These materials — the world's largest collection of plant diversity for food and agriculture — are fundamental to CGIAR plant breeding. Committed to managing these collections for the global community and to serve the developing world in particular, the CGIAR is upgrading its genebank facilities and instituting the highest international standards of genebank management to buttress secure conservation with improved transparency, access and cost-effectiveness. In January 2008, the CGIAR shipped duplicate seed of some 200,000 crop samples to Norway's new Svalbard Global Seed Vault, the repository of last resort for humanity's agricultural heritage.

WOMEN IN AGRICULTURAL SCIENCE

Nowhere else in the world are the challenges to agriculture more complex, and agricultural production so highly gendered, as in sub-Saharan Africa. While women produce 60-80% of African crops, less than one in five agricultural researchers in Africa is female. To address this disparity, the CGIAR's African Women in Agricultural Research and Development (AWARD) Program is building up the talent pool of promising African women in agricultural science. Through the AWARD fellowship program, hundreds of female agricultural scientists from 10 countries across Africa benefit from leadership training, mentoring, networking, participation in international conferences, and competitive research attachments with partnering organizations to help them realize their potential and tap their talents to better serve the poor women who are the majority of African smallholder farmers.