A Partnership for Research and Development
China and the CGIAR
China-CGIAR Partnership

The People’s Republic of China has a long history of international scientific cooperation in agricultural and rural development. Although China formally joined the CGIAR in 1984, its cooperation with the international centers predates the founding of the CGIAR in 1971. Today, China is widely recognized as a role model in marshaling science and technology for rapid economic transformation and national development.

China is one of the world’s oldest civilizations with a strong farming tradition. China is the world’s most populous country, and has the fastest growing economy, currently ranked fourth in the world. China has reduced poverty dramatically, faster than any other country in human history: for example, there were 400 million fewer poor people in 2001 than 20 years earlier. China’s aggressive agricultural reforms have unleashed rapid economic growth, helping boost per capita gross domestic product from US$1,071 in 1978 to US$4,726 in 2003. China feeds over 20 percent of the world’s population using only 9 percent of the world’s arable land. China is the world’s largest grower of CGIAR mandate crops such as rice, wheat, groundnut, sorghum and millet, and roots and tubers. Indeed for most major farm commodities, China’s share of world production exceeds its share of world population.

Seen against this backdrop, the CGIAR is privileged to have a strong, fruitful and expanding partnership with China, and pleased to have played a supportive role in the nation’s agricultural transformation. The China-CGIAR partnership is marked by a set of mutually-reinforcing objectives such as increasing the productivity of agriculture, reducing poverty through wealth creation, and protecting natural resources such as biodiversity, forests, soils and water. China’s partnership with CGIAR Centers focuses on major food crops (maize, potatoes, rice and wheat), land and water management, livestock, forestry, fisheries, and food policy. In a compelling example of the benefits attributable to the China-CGIAR partnership, nationwide approximately 20 percent of rice germplasm can be traced to IRRI varieties. In the famed wheat-growing areas of Yunnan province, or maize-growing Guanxi province, material from CIMMYT comprises about 50 percent of the germplasm. Furthermore, China has bred more than 260 various crop varieties containing genetic material from CGIAR Centers.

The CGIAR works primarily through the Chinese Academy of Agricultural Sciences (CAAS), the research arm of the Chinese Ministry of Agriculture. In addition, CGIAR enjoys strong relations with the Chinese Academy of Science (CAS), and affiliated institutions and centers of excellence. Scientific partnerships between Chinese and CGIAR scientists abound throughout the CGIAR System. Over 50 Chinese institutions have collaborated closely with CGIAR Centers. Four Chinese scientists serve on Center Boards (CIP, IFPRI, IRRI and WorldFish Center).
More than 3,400 Chinese scientists have received training at CGIAR Centers, many of whom are now occupying leadership positions throughout the CGIAR and at Chinese organizations.

In a sign of the growing strength of the China-CGIAR partnership, seven CGIAR Centers (CIMMYT, CIP, ICRAF, IFPRI, ILRI, IPGRI, and IRRI) have regional offices in China, located at the CAAS campus. These strengthened ties bode well for the future of the China-CGIAR partnership.

Examples of the China-CGIAR Partnership

Raising rice productivity: Rice is the most important food crop in China. High-yielding rice varieties developed by IRRI (including IR-8) were used by Chinese researchers well before a formal relationship was established in 1982. Since the opening of an IRRI liaison office in Beijing in 1997, IRRI and Chinese scientists have collaborated on 48 different projects with 18 ongoing. Overall, IRRI’s impact in China has been extensive:

- About 90% of Chinese hybrid rice varieties—which account for about half of China’s rice production—have IRRI parentage.
- Since 1981, 37 modern varieties shared via IRRI’s breeding network have been released to Chinese rice growers providing 5.45MT in additional rice and US$465 million in additional income to farmers.

Combating rice pests, naturally: Diseases and insect pests pose serious threats to Chinese rice production. In 1997, IRRI led a program in collaboration with the Yunnan Agricultural University to “interplant” different rice varieties to exploit biodiversity as a way to resist pest attacks. By 2004, the technique had spread successfully to more than 200,000 ha in Yunnan Province allowing farmers to enjoy increased incomes of up to $150/ha. The New York Times described the project as a “stunning success” and one of the “largest agricultural experiments” ever.

Capacity building and research collaboration: In addition to the 98 Chinese PhDs and MSc trained at IRRI since 1984, hundreds of Chinese researchers have been sponsored to attend important conferences and workshops overseas, including 113 different training programs and courses. Research collaboration has focused on the following areas:

- Molecular breeding: about 50 Chinese scientists involved;
- The Irrigated Rice Research Consortium: 8 institutes, about 16 Chinese scientists;
- Site Specific Nutrient Management: 7 institutes and about 10 Chinese scientists;
- IPM and biodiversity: about 100 Chinese scientists;
- Water saving: 5 Chinese institutes; and
- The International Network for the Genetic Evaluation of Rice: 13 institutes and about 50 Chinese scientists.
Fighting hunger through improved maize: According to IFPRI projections, demand for cereal crops, especially maize, will continue to increase dramatically over the next 20 years. Maize accounts for approximately 24% of the total harvest in China, and demand is also rising rapidly all across Asia. In an attempt to address some of these challenges, CIMMYT has planted more than one million ha of its maize varieties across China. CIMMYT through the Asian Maize Biotechnology Network (AMBIONET) collaborates with CAAS in applying advanced biotechnology for maize improvement throughout China. More than 100 Chinese scientists have participated in CIMMYT knowledge exchange programs on hybrid maize technology and seed production.

Reducing disease in roots and tubers: China is one of the largest users of CIP germplasm worldwide and we have active collaboration with Chinese breeders in both crops in many regions. Since 2000, CIP and Chinese scientists have collaborated through the organization of South East Asian regional courses on potato and sweetpotato.

Sweet potato: In 1987, CIP began collaborating with Chinese scientists to develop new technologies to eliminate viral diseases in sweet potatoes. The techniques included new methods to identify viruses in sweet potato roots, and better systems for multiplying improved virus-free plant varieties. By the early 1990’s, these efforts helped boost sweet potato production by over 30% and expanding cultivated area to over 600,000 ha in Shandong Province.

Potato: In 1978, China and CIP worked together to develop a disease-resistant potato (CIP-24), which is grown on approximately 70,000 ha, principally in China’s drought-prone Northern provinces. CIP collaborates with the Root and Tuber Crop Research Institute of Yunnan Normal University and the Huize Agricultural Extension Center and has developed “Cooperation 88”, a high-yielding potato variety currently grown on more than 100,000 ha in Yunnan Province alone.

Winning steps for wheat: Wheat is China’s second most important food crop after rice, accounting for 25% of food production. CIMMYT is helping China address future increases in wheat demand in several aspects. The following show CIMMYT’s impacts:

- China has provided more than 1,000 commercial wheat lines to CIMMYT. In turn, China’s wheat program has received more than 15,000 experimental strains of wheat from CIMMYT. CIMMYT wheats contribute high yield potential, resistance to disease, and better quality to Chinese germplasm.
- CIMMYT and CAAS jointly operate an internationally recognized wheat quality program to meet the demand for quality improvement.
CIMMYT and Chinese scientists have developed shuttle breeding programs for improving resistance to fusarium diseases and yellow rust.

CIMMYT has trained over 100 Chinese wheat scientists that currently lead wheat breeding programs at provincial and national levels.

CIMMYT and China have established an information and germplasm exchange program with the participation of more than 60 institutes across China.

**Exchanging knowledge on hillside agriculture:**
CIAT’s experience with hillside agriculture in the Andes (Bolivia, Colombia and Ecuador) has led to partnerships and regional exchanges with related institutions in China’s Yunnan Province. CIAT, with funding from the Inter-American Development Bank, is facilitating joint field visits, fieldwork, workshops and visits to communities.

**Buckwheat revitalized:** IPGRI has supported work on buckwheat in the mountainous regions of southwest China since the early 1990s. Studies of buckwheat with the Chengdu Institute of Biology, CAS, starting in 1996, indicated strong support for the conservation of buckwheat diversity on farms. A second study, involving Zhaojue Agricultural Research Institute in Liangshan Autonomous Region of China and Chengdu Institute of Biology surveyed local farmers to discover how they handle and conserve the crop and mapped buckwheat biodiversity. The most recent development is to promote tartary buckwheat as a crop to improve livelihoods. A study in Shanxi Province indicated the high potential of buckwheat as a nutritious food, conferring better health, and suggested avenues for smaller farmers to process and market buckwheat products, thereby capturing more value from their harvest. In the laboratory, work with the Chinese Academy of Agricultural Sciences is focused on molecular characteristics of buckwheat, which will help farmers and scientists to breed better varieties more rapidly.

**Partnerships to improve crop-livestock farming systems:** Mixed farming systems that integrate crop and animal production form the backbone of small-scale Asian agriculture. From 1999 to 2004, the Africa-based International Livestock Research Institute (ILRI) collaborated with the Sichuan Animal Science Academy, the Yunnan Beef Cattle and Pasture Research Center, and national agricultural research systems in four Southeast Asian countries in a Crop-Animal System Research Network (CASREN). Funded by the Asian Development Bank, CASREN applied holistic and participatory research-for-development approaches.

ILRI began collaborating with Chinese scientists and institutions in Yunnan in 1999 and in Sichuan in 2002. CASREN projects provided farm communities with enhanced pig-feed technologies using sweet potatoes in Sichuan Province and enhanced smallholder production of beef cattle and goats in the rainfed maize-and-wheat farming systems of Yunnan Province.

ILRI’s sister Future Harvest Centre, the International Potato Center (CIP), became a research partner in the Sichuan project that greatly enhanced smallholder use of sweet potatoes as pig feed.
The success of CASREN's work in Sichuan, where many farm households more than doubled their incomes by adopting CASREN potato silage technologies, has induced the CGIAR System-wide Livestock Program to fund related research within China and Southeast Asia.

In May 2004, CAAS and ILRI established a Joint Laboratory on Livestock and Forage Genetic Resources (JLLFGR) within the CAAS Institute of Animal Sciences, in Beijing. ILRI and CAAS scientists working in this Joint Laboratory are applying state-of-the-art techniques to collect, characterize and conserve indigenous livestock and forage genetic resources in China and Southeast Asia. The Joint Laboratory is serving as a research platform to build biotechnology as well as genetics research capacity in the region.

**Bed planting in the Yellow River:** Serious water and soil erosion in the Yellow River has led to frequent basin-wide drought and floods. In 2000, an estimated 110 million Chinese lived in the basin area where food per capita was nearly 20% less than in the rest of China. The CGIAR Challenge Program on Water and Food (CPWF) is cooperating with the Yellow River Conservancy Commission which acts as a basin coordination institution to develop projects aimed at improving all aspects of water management. Under this umbrella, the CPWF works with several Chinese researchers and institutions on issues such as aerobic rice breeding, groundwater governance, and bed planting.

In one example of impact, from 1998 to 2003, CIMMYT extended bed planting in the Yellow River Basin's Shandong Province from a few test plots to more than 26,000 ha. This particular method of water management involves planting crops on raised beds and applying inputs, including irrigation water in furrows. Bed planting improves soil fertility and structure and helps reduce erosion, water usage, herbicide use and facilitates mechanical and manual weeding. The technique has the potential to achieve 30-40% water savings in the river basin.

**Pigeonpea in Chinese diets:** In 1998, ICRISAT researchers successfully introduced pigeonpea in Guangxi and Yunnan provinces primarily for soil conservation. Six years later, the total area planted to pigeonpeas was over 60,000 ha. The pigeonpea is a hardy, drought-tolerant food legume high (20-22%) in protein and offers the added benefit of fixing nitrogen and other nutrients in the soil. CAAS is working to promote pigeonpea cultivation in three more provinces characterized by harsh, dry land farming conditions. Pigeonpea is suitable fodder for cattle, goats and rabbits. Recently, an export market for fresh pigeonpea vegetable seed has also been established and it has enhanced farmers' income significantly.

**Addressing problems with China's timber imports:** In 1998, more than 4,000 people died in floods blamed on excessive deforestation. Subsequently, China implemented a widespread ban on logging. It was feared that this ban would lead to an increase in China's timber imports and cause serious adverse consequences for forests in Southeast Asia and eastern Russia. In 2004, CIFOR and Forest
Trends launched a multi-partner project that seeks to increase the level of information available about timber demand and trade and associated environmental impacts. The project will link with regional networks, identify leverage points where advocates can effect change, and develop policy relevant scenarios to help make forest industries and markets more responsive to the needs of smallholders and low-income producers.

**Improving national forest policy:** Since 1978, China has undergone important policy reforms affecting forest resources, creating major opportunities for promoting environmentally-friendly forestry techniques. In recent years, concerns have emerged regarding rising demand for timber, adequate distribution of benefits from forestry development and protecting the rights of local people living near forest areas. CIFOR has collaborated with the China Council for International Cooperation on Environment and Development, which encompasses the influential policy-making Task Force on Forests and Grasslands that is building support for policy reform through rigorous fieldwork and by strengthening China’s capacity for policy analysis. CIFOR has exchanged knowledge with policymakers of the Task Force through local seminars and major symposia involving sponsors from around the world.

**Regional pesticide use cut:** Misuse and overuse of insecticide sprays by Asian rice farmers is dangerous to human health and damaging to the environment. In an attempt to cut pesticide use in the region, IRRI researchers have launched an innovative, basin-wide public information campaign in the Mekong River Delta that is reaching 92% of the delta’s 2.3 million farm households including in China. Overall, insecticide use has decreased by 72%. Paddy production in the delta increased to 14 million tons (up from 11 million tons). The campaign, which won Scotland’s St. Andrew’s Environmental Prize, is now being extended to one million rice farmers along the Red River which flows through China and Vietnam, and into the South China Sea.
Nourishing the Future through Scientific Excellence
The Consultative Group on International Agricultural Research (CGIAR)

The Consultative Group on International Agricultural Research (CGIAR) is a strategic alliance of countries, international and regional organizations, and private foundations supporting 15 international agricultural research Centers that work with national agricultural research systems, civil society organizations and the private sector. The alliance mobilizes agricultural science to reduce poverty, foster human well-being, promote agricultural growth, and protect the environment. The CGIAR generates global public goods that are available to all.

Agriculture, the key to development

In a world where 75 percent of poor people depend on agriculture to survive, poverty cannot be reduced without investment in agriculture. Many countries with the strong agricultural sectors have a record of sustained investments in agricultural science and technology. The evidence is clear — investment in agricultural research for development generates growth, reduces poverty and protects the environment.

Agricultural research benefits people and the planet

Agricultural research for development has a record of delivering results. The science that made possible the Green Revolution of the 1960s and 1970s was largely the work of CGIAR Centers and their national agricultural research partners. The scientists' work not only increased incomes for small farmers, it enabled the preservation of millions of hectares of forest and grasslands, conserving biodiversity and reducing carbon releases into the atmosphere. CGIAR's research agenda is dynamic, flexible, and responsive to emerging development challenges. The research portfolio has evolved from the original focus on increasing productivity in individual critical food crops. Today's approach recognizes that biodiversity and environment research are also key components in the drive to enhance sustainable agricultural productivity. Our belief in the fundamentals remains as strong as ever: agricultural growth and increased farm productivity in developing countries creates wealth, reduces poverty and hunger and protects the environment (see graphic, Evolution of CGIAR's research agenda).

CGIAR Priority Investments 2004

- Sustainable Production 35%
- Germplasm Collection 12%
- Policy 16%
- Enhancing NARS 20%
- Germplasm Improvement 17%
Agricultural research is delivering results

The CGIAR’s more recent outstanding achievements include:

- Releasing Quality Protein Maize (QPM) varieties in 25 countries. They are currently grown on more than 650,000 hectares.
- Transforming agriculture in East and West Africa through the release of New Rices for Africa (NERICAs). It is estimated that NERICAs are planted on 130,000 hectares across Africa, including approximately 60,000 hectares in Guinea and about 10,000 hectares in Uganda.
- Selectively breeding a GIFT strain of tilapia which shows an approximate growth rate gain of 70%.
- Training over 75,000 developing country scientists and researchers.
- Reducing pesticide use in developing countries by promoting integrated pest management and biological control methods.
- Adopting low-till farming practices in Asia on 1.2 million hectares across the Indo-Gangetic plains, boosting farm incomes and productivity.
- Enabling African producers to access international pigeonpea markets.
- Releasing over 45 bean varieties, developed from CGIAR germplasm across Latin America.
- Improving forage grasses developed by CGIAR researchers and partners which are currently grown on over 100 million hectares in Latin America.
- Planting fodder shrubs in Kenya and increasing smallholder dairy farmers’ income by US$166 per annum.

CGIAR’s Evolving Research Agenda
These successes notwithstanding, future challenges are daunting. World population is expected to reach 9 billion people by 2050. Food demand is expected to more than double in a similar time frame. Some 30 percent of irrigated lands are already degraded, and water use is expected to increase by 50 percent over the next 30 years. Science-based solutions for sustaining productivity increases while protecting ecosystems are key to addressing these challenges.

Increasing sustainable productivity, strengthening science-for-development partnerships, protecting the environment

The CGIAR was created in 1971. Today more than 8,500 CGIAR scientists and staff are working in over 100 countries. CGIAR research addresses every critical component of the agricultural sector including — agroforestry, biodiversity, food, forage and tree crops, pro-environment farming techniques, fisheries, forestry, livestock, food policies and agricultural research services. Thirteen of the Centers are located in developing countries. Africa continues to be a priority for CGIAR research. CGIAR research partnerships help achieve the Millennium Development Goals and support major international conventions (Biodiversity, Climate Change, and Desertification).

The CGIAR has five areas of focus

- Sustainable production (of crops, livestock, fisheries, forests and natural resources)
- Enhancing National Agricultural Research Systems NARS (through joint research, policy support, training and knowledge-sharing)
- Germplasm Improvement (for priority crops, livestock, trees and fish)
- Germplasm Collection (collecting, characterizing and conserving genetic resources — the CGIAR holds in public trust one of the world’s largest seed collections available to all)
- Policy (fostering research on policies that have a major impact on agriculture, food, health, spread of new technologies and the management and conservation of natural resources)
Forging New Partnerships: CGIAR Challenge Programs in Action

Challenge Programs are new high-impact, research for development programs that tackle major global development challenges through expanded partnerships. Four Challenge Programs are being implemented since 2004:

- "Generation" is unlocking crop genetic diversity through the application of comparative biological knowledge in 11 crops. There are 14 partner institutions involved. Program updates for the first year include genotyping a composite germplasm set representing global genetic resources for a first tier of eleven crops; development of a common phenotyping framework of techniques, plant development stages and parameters to enable cross-species comparison; validation and development of pre-existing markers for drought tolerance and the establishment of molecular breeding communities of practice; design of Generation CP information platform system for genetic resources, genomic and crop information systems and internal project workshops. (www.generationcp.org)

- "HarvestPlus" is an international alliance of over 40 institutions breeding crops with improved micronutrient content. Progress during the first phase of the project focused on: exploring the genetic variation for iron, zinc and B-carotene in rice, wheat, maize, cassava, beans and sweetpotato germplasm; applied breeding; testing the stability of micro-nutrient expression; and dissemination of seed of basic breeding materials and advanced lines to collaborators. New initiatives include the feasibility of a HarvestPlus China program, similar to HarvestPlus and to be funded by the Chinese government and other donors. (www.harvestplus.org)

- "Water and Food" is improving water productivity in agriculture in nine river basins (Andean system, Indo-Gangetic, Kharheh, Limpopo river, Mekong river, Nile river, Sao Francisco, Volta, Yellow river). In its first year, 33 research projects led by 18 different institutions, involving over 150 partners have been launched with a total investment of $60 million. A diverse set of activities are underway, including research programs on coastal management in Bangladesh and Vietnam; exploring and evaluating supplemental irrigation techniques in Syria, and improvements in rain water and nutrient use efficiency in Niger. (www.waterforfood.org)

- The Sub-Saharan Africa Challenge Program (SSA CP) developed by a CGIAR partner, the Forum for Agricultural Research in Africa (FARA), is focusing on jumpstarting agricultural development in Sub-Saharan Africa. Fully supported by the CGIAR, this is the first Challenge Program with responsibility for implementation assigned to a partner institution in Africa.
The SSA CP is promoting research that will provide options for smallholders to improve input and output markets for smallholder and pastoral produce, to intensify use of limited resources while maintaining food security and the use of natural resources in a sustainable way. The research will be conducted by Pilot Learning Teams with the communities at different Pilot Learning Sites, which have been already selected through a participatory process. (www.fara-africa.org)

The CGIAR alliance is open to all countries and organizations sharing a commitment to a common research agenda and willing to invest financial support, and human and technical resources. From twelve members in 1971, today's membership of sixty-four includes a majority of developing countries. Membership is poised to grow further.

CGIAR members contributed US$437 million in 2004, the single-largest public goods investment in mobilizing science for the benefit of poor farming communities worldwide.
A Global CGIAR

Future Harvest Centers of the CGIAR

- Africa Rice Center (WARDA)
  www.warda.org
- International Center for Tropical Agriculture (CIAT)
  www.ciat.cgiar.org
- Center for International Forestry Research (CIFOR)
  www.cifor.cgiar.org
- International Maize and Wheat Improvement Center (CIMMYT)
  www.cimmyt.org
- International Potato Center (CIP)
  www.cipotato.org
- International Center for Agricultural Research in the Dry Areas (ICARDA)
  www.icarda.org
- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
  www.icrisat.org
- International Food Policy Research Institute (IFPRI)
  www.ifpri.org
- International Institute of Tropical Agriculture (IITA)
  www.iita.org
- International Livestock Research Institute (ILRI)
  www.ilri.org
- International Plant Genetic Resources Institute (IPGRI)
  www.ipgri.org
- International Rice Research Institute (IRRI)
  www.irri.org
- International Water Management Institute (IWMI)
  www.iwmi.cgiar.org
- World Agroforestry Centre (ICRAF)
  www.worldagroforestry.org
- WorldFish Center
  www.worldfishcenter.org

Placement markers are approximate and indicate city locations, not worldwide offices.
Research is a Collaborative Enterprise

The CGIAR’s achievements would not be possible without the support and commitment of the 64 members and many hundreds of partner organizations who together form the growing CGIAR alliance.

CGIAR Members

African Development Bank
Arab Fund for Economic and Social Development
Asian Development Bank
Australia
Austria
Bangladesh
Belgium
Brazil
Canada
China
Colombia
Commission of the European Community
Côte d’Ivoire
Denmark
Arab Republic of Egypt
Finland
Food and Agriculture Organization of the United Nations
Ford Foundation
France
Germany
Gulf Cooperation Council
India
Indonesia
Inter-American Development Bank
International Development Research Centre
International Fund for Agricultural Development
Islamic Republic of Iran
Ireland
Israel
Italy
Japan
Kellogg Foundation
Kenya
Republic of Korea
Luxembourg
Malaysia
Mexico
Morocco
Netherlands
New Zealand
Nigeria
Norway
OPEC Fund for International Development
Pakistan
Peru
Philippines
Portugal
Rockefeller Foundation
Romania
Russian Federation
South Africa
Spain
Sweden
Switzerland
Syngenta Foundation for Sustainable Agriculture
Syrian Arab Republic
Thailand
Turkey
Uganda
United Kingdom
United Nations Development Programme
United Nations Environment Programme
United States of America
World Bank