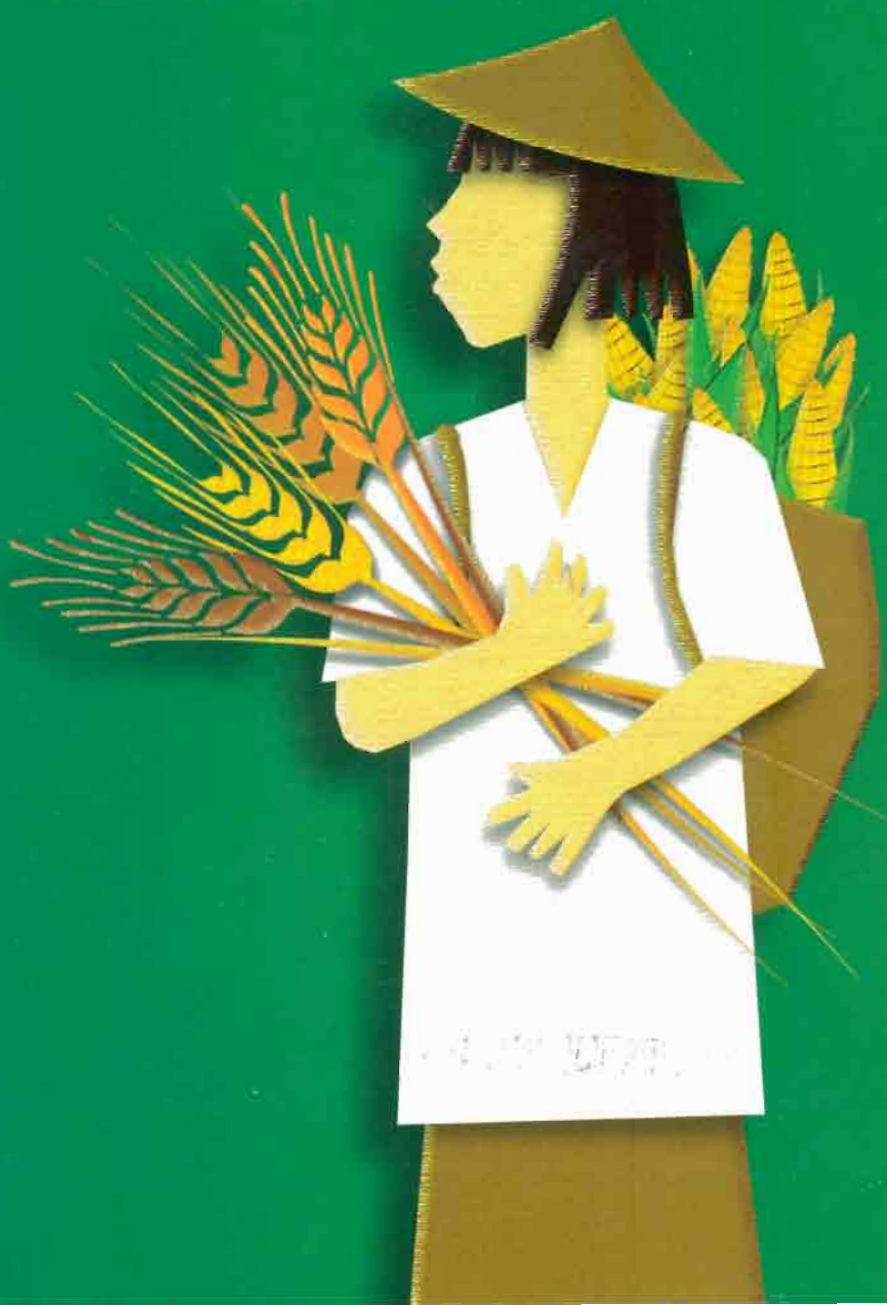
CIMMYT IN ASIA

Asia plants more than half of the developing world's wheat crop and almost half of its maize crop. So why should anyone be concerned about Asian agriculture? The answer is that improvements in agriculture are often the only means for vast numbers of impoverished farmers and consumers to escape the effects of poverty, food insecurity, and environmental decline.



Millions of Asians cannot grow or buy the food they need. More productive, sustainable agriculture will generate income, create employment, and make more food available to those who need it most. The alternative—greater numbers of poor and marginalized people with little hope for bettering their circumstances—is unconscionable.

CIMMYT (the International Maize and Wheat Improvement Center) presently dedicates one-third of its budget to efforts in Asia. Through our research partnerships, we develop innovative technologies that improve the productivity and profitability of maize and wheat cropping systems in a sustainable way—conserving natural resources, protecting the environment.

Why Asia?

Consider that:

- More poor people live in South Asia than anywhere else in the world. Of the 800 million hungry people in the world, 350 million live in South Asia alone. The need for agricultural options that raise incomes and provide employment is acute.
- Growing populations will need more food. Of the ten nations with the highest population growth, six are Asian: India, China, Pakistan, Indonesia, Bangladesh, and the Philippines. South Asia, where population growth alone causes demand for food grain to rise by 2.5% every year, faces a projected wheat deficit of 21.3 million tons by 2020.
- Demand for maize, projected to grow by 5% annually in Asia through 2005, is greater than for any other crop, including rice. At this rate of growth, demand for maize will double every 15 years. Without major production increases, the Asian region will become a net importer of maize.
- More than 85% of the wheat consumed in South and East Asia is consumed directly as food. Nearly 76% of the maize consumed in South Asia is consumed directly as food, though most maize in East Asia is used for animal feed. (In contrast, in Europe, 46% of all wheat and only 6.6% of maize are directly consumed as food.)
- Arable land per person is dwindling in Asia. Land holdings in many areas have become smaller and more fragmented. In 1980, 10 rural people produced food for 15 people on 2.49 ha; in 1990, 10 rural people produced food for 17 people on 2.27 ha. More food will have to be produced on less land in the future.
- Water resources for agriculture are at risk. Among developing countries, India is projected to have the largest absolute increase in water withdrawals between 1995 and 2020. China will have the most dramatic transformation in water demand; the share of domestic and industrial use in total water demand will grow from 13% in 1995 to 35% in 2020.

A New Regional Research Approach

Despite remarkable advances in agriculture (see the fact sheet on research impacts), the struggle for subsistence will remain a daily battle for many Asians unless they have better access to the benefits of agricultural research.

With its partners, CIMMYT is taking a new approach to fostering food security in Asia. CIMMYT has concentrated most of its research for Asia in two large projects, described very briefly below. The projects draw on efforts of scientists from many disciplines and partner organizations to meet the major challenges to maize and wheat production in Asia.

Meeting the Accelerating Demand for Maize Development, Production, and Delivery in South and Southeast Asia and China

As demand for maize in Asia rapidly outpaces supply, farmers are growing more maize in hillside and marginal environments and as a component of already intensive cropping systems. This project seeks to foster sustainable improvements in maize production by developing better germplasm and management practices to address important production constraints and meet the needs for maize production in marginal environments and intensive crop rotations. Through this project, we and our partners:

- Increase food security in Asia.
- Increase the development of improved hybrids and open-pollinated varieties for sustainable production systems—resulting in higher productivity.

- Reduce maize crop losses to biotic and abiotic stresses—reducing dependence on agrochemicals.
- Increase the cooperation and coordination between private seed companies and public-sector breeding institutions, to improve the delivery of enhanced germplasm to small-scale farmers.
- Provide information to policy makers and research managers for setting research priorities for economic and noneconomic objectives.
- Train national research scientists in biotechnology applications for maize breeding.

Sustainable Wheat Production Systems in the Indo-Gangetic Plains and China

Essentially, this project seeks to develop and deploy more efficient, productive, and sustainable technologies for Asia's diverse wheat production systems, with the ultimate objective of increasing farmers' incomes. Through this project, we and our partners:

- Improve the targeting of promising technologies, both agronomic and germplasm-based.
- Improve research priority setting and impact assessment within the region.
- Promote more effective use of geographic information systems (GIS) and crop modeling throughout the region.
- Increase wheat productivity, as more cultivars adapted to the needs of the rice-wheat cropping system are released.
- Increase the total income of farmers in this poor, densely populated region.

Facets of Our Work for Asia

The table indicates of the range of collaborative activities undertaken for Asia (space does not allow us to list every activity). These activities emphasize our commitment to three areas of research that are integral to alleviating poverty: plant breeding to develop improved strains of maize and wheat; natural resource conservation; and appropriate economic policies. They also indicate our considerable commitment to biotechnology research with partners in Asia.

Research focus	Activity
Superior maize and wheat	Develop and evaluate maize inbred lines, conduct research on maize testers; group germplasm for heterotic patterns.
	Evaluate maize testcrosses and hybrids.
	Test maize hybrids, open-pollinated varieties, inbred lines, and other materials in regional trials.
	Screen maize lines for stress tolerance/resistance, especially to downy mildew disease, turcicum disease, Asian borers, and drought.
	Identify wheat varieties resistant to Fusarium for the Yangtze region of China.
	Screen wheat varieties for constraints common to the eastern Gangetic Plains, especially helminthosporium leaf blight (HLB), a disease that has grown in importance with the spread of rice-wheat cropping systems.
	Screen wheat for phosphorus efficiency.
	As an important component of variety development, conduct wheat crop surveillance and crop loss assessments for HLB and the wheat rusts.
Strengthened maize and wheat crop management systems to sustain natural resource productivity	Conduct research to address problems and issues of maize-rice production systems (Thailand, Philippines).
	Conduct research to address declining maize yields in hillside cropping systems of Nepal (develop and disseminate improved maize varieties specifically adapted to hillside cropping systems and stresses; develop resource-conserving and productivity-enhancing crop management practices).
	Offer special sessions at regional workshops on maize agronomy and sustainable maize-based production systems.

Research focus	Activity
Strengthened maize and wheat crop management systems to sustain natural resource productivity (cont'd)	Conduct traveling maize workshops in the region.
	Train agronomy researchers and extension specialists in maize crop management research and enhance their capacity for adaptive research (training suspended pending further funding).
	Develop reduced and zero tillage systems for timely wheat planting, improved plant stands, and increased water and nutrient efficiency in South Asia's irrigated rice-wheat cropping systems.
	Assess and analyze productivity trends in the rice-wheat systems of the Indo-Gangetic Plains (including data from various long-term experiments conducted by national program partners).
	Characterize wheat systems in Southeast Asia: produce climate surfaces for the region; digital maps of soils and major disease, weed, and pest problems; cropping systems; and modeled socioeconomic data, including human population density and access to transportation.
	Develop bed planting methods to increase the efficiency of nutrient and water use and reduce populations of the grassy weed *Phalaris minor* in South Asia's irrigated wheat systems.
Farmer participatory research	Conduct farmer participatory research on use of tillage technologies in South Asia's rice-wheat systems, especially mechanized technologies. Research to improve the productivity of hillside maize systems in Nepal also relies heavily on farmers' knowledge and participation.
Maize and wheat biotechnology	Promote communication and share technologies and germplasm products among collaborating partners in AMBIONET (the Asian Maize Biotechnology Network) to facilitate more rapid, efficient development of improved maize. AMBIONET partners are: using molecular markers to characterize heterotic groupings of maize germplasm; developing molecular markers for *resistance to MRDV and SCMV, for drought and low nitrogen tolerance, and for downy mildew* resistance; characterizing downy mildew pathogens; and using marker-assisted selection to introduce downy mildew resistance into a popular Philippine maize variety.
	Map durable resistance to leaf rust, yellow rust, and fusarium head scab in wheat.
	Find markers for resistance to BYDV, which particularly affects wheat in China.
	Map drought tolerance in wheat.
	Develop wheats with resistance to fungal pathogens that are important in Asia.
Impacts of maize and wheat research	Document the release and spread of improved wheat varieties in developing countries during the 1990s.
	Establish a network of Asian researchers to update the maize impact study conducted in the early 1990s. This work will feature more comprehensive information from private seed companies and more accurate projections of supply and demand for maize in the region.
Genetic diversity	Assess levels of wheat genetic diversity in selected areas of China and Australia and examine the interaction of diversity with crop productivity, stability, household preferences for growing different kinds of wheat varieties, and policy.
Maize seed studies and production	Monitor trends in maize seed industries in developing countries, including Asian countries (studies have been done in India, Thailand, and China).
	Enhance regional capacity to produce and use improved maize seed through courses in seed production.
Public- and private-sector partnerships in maize research and seed production	Encourage participation and support of the private sector in regional maize workshops.
	Foster active participation of the private sector in hybrid maize technology courses.
	Include hybrids from the private sector in TAMNET (Tropical Asian Maize Network) trials.
	Encourage the private sector to participate in TAMNET discussion sessions.
	Announce the availability of maize germplasm with different traits.

Links with Partners: A Few Examples

- Research on Asia's wheat production systems, including its rice-wheat production systems, features extensive collaborative arrangements with: scientists from national programs and universities in the region; the Rice-Wheat Consortium for the Indo-Gangetic Plains, for which CIMMYT is now the convening research center (see fact sheet); Cornell University (soil management, soil health, wheat sterility, GIS); Australia's CRC for Molecular Plant Breeding; IACR-Rothamsted (nutrient management); IRRI (nutrient management and GIS); Louvain-la-Neuve (foliar diseases); ICIMOD, ICRISAT, IWMI, and Texas A&M University (GIS); Michigan State University (modeling); University of Adelaide/ ACIAR (weed studies); and the University of Sydney and University of Minnesota (rust studies). In wheat breeding research, our collaboration with India and China has been quite strong.

- CIMMYT's maize research partners include scientists from national programs and universities in the region; the private sector; TAMNET (consisting of national research organizations and private companies); and AMBIONET. In collaboration with agricultural research programs and universities in the region, CIMMYT has organized a series of training courses on maize population improvement and hybrid breeding, focusing on such topics as heterotic patterns, testers, seed production, experimental designs, and computer applications. Courses have taken place in China, India, Nepal, the Philippines, and Thailand. The most recent course, in Thailand, drew 80 participants from a range of public and private institutions.

- Research in the mid- and high hills of Nepal, where maize surpasses rice as a staple food, brings together farmers, researchers from CIMMYT and local institutions such as Nepal's National Maize Research Program, and NGOs in efforts to address declining maize yields in hillside cropping systems. The project aims to build a sustained research capacity in local and allied institutions through training programs and dissemination of information and results. This project also has the potential to improve similar maize systems in other parts of South Asia.

- Economics Program researchers and partners are analyzing maize research impacts and maize supply and demand in Asia. Yearly workshops are scheduled to review progress and plan further research, and a staff member has been posted to the Philippines to coordinate this work. Results will be made available in a series of publications.

- AMBIONET, which is funded by the Asian Development Bank, relies on the expertise of researchers from: the Chinese Academy of Agricultural Sciences; the Directorate of Maize Research and the Molecular Genetics Section of the Indian Agricultural Research Institute; the Research Institute for Maize and Other Cereals, Indonesia; the Research Institute for Food Crops Biotechnology, Indonesia; the Institute of Plant Breeding of the University of the Philippines; Kasetsart University and the Department of Agriculture, Thailand; and CIMMYT.

More Links with Partners

- **Thousands of researchers from Asia have participated in CIMMYT training courses. Many distinguished Asian researchers have come to CIMMYT headquarters as Visiting Scientists, making substantial contributions to shared research goals.**
- **Regional conferences and workshops periodically assemble researchers, policy makers, and other members of the development community. These meetings are essential for disseminating information and coordinating research. (For example, the Asian Regional Maize Workshop in the Philippines in 1998 was attended by an impressive array of experts on maize research and development.) Aside from the proceedings of these workshops, numerous publications (print and electronic), including articles in refereed journals of international importance, document the work of our partners in Asia.**

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INTERNATIONAL MAIZE AND WHEAT IMPROVEMENT CENTER

MORE INFORMATION: SEE FACT SHEET ON CIMMYT CONTACTS IN ASIA

ACRONYMS/ABBREVIATIONS: ACIAR (Australian Centre for International Agricultural Research); AMBIONET (Asian Maize Biotechnology Network); BYDV (barley yellow dwarf virus); CIMMYT (International Maize and Wheat Improvement Center); CRC (Collaborative Research Centre); GIS (geographic information systems); IACR (Institute of Arable Crops Research); ICIMOD (International Centre for Irrigated Mountain Development); ICRISAT (International Crops Research Institute for the Semi-Arid Tropicas); IRRI (International Rice Research Institute); IWMI (International Water Management Institute); MRDV (maize rough dwarf virus); SCMV (sugarcane mosaic virus); TAMNET (Tropical Asian Maize Network).

CIMMYT

CIMMYT (www.cimmyt.mx or www.cimmyt.cgiar.org) is an internationally funded, nonprofit scientific research and training organization. Headquartered in Mexico, the Center works with agricultural research institutions worldwide to improve the productivity, profitability, and sustainability of maize and wheat systems for poor farmers in developing countries. It is one of 16 similar centers supported by the Consultative Group on International Agricultural Research (CGIAR). The CGIAR comprises about 60 partner countries, international and regional organizations, and private foundations. It is co-sponsored by the Food and Agriculture Organization (FAO) of the United Nations, the International Bank for Reconstruction and Development (World Bank), the United Nations Development Programme (UNDP), and the United Nations Environment Programme (UNEP). Financial support for CIMMYT's research agenda also comes from many other sources, including foundations, development banks, and public and private agencies.

Future Harvest

CIMMYT supports Future Harvest, a public awareness campaign that builds understanding about the importance of agricultural issues and international agricultural research. Future Harvest links respected research institutions, influential public figures, and leading agricultural scientists to underscore the wider social benefits of improved agriculture—peace, prosperity, environmental renewal, health, and the alleviation of human suffering (www.futureharvest.org).

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