

CIMMYT IN AFRICA

CIMMYT began working
with national research
programs in Africa even before the



Center was officially opened in 1966.

Today the Center spends around 40%
of its budget in this region, amounting
to about US\$ 15 million per annum.

**This is one of the highest
three or four investments in
sub-Saharan Africa across
the entire Consultative
Group for International
Agricultural Research
(CGIAR).**



CIMMYT's regional presence is substantial. As of 1998, 18 internationally recruited staff worked out of offices in Ethiopia, Kenya, and Zimbabwe (see fact sheet with contact information). CIMMYT headquarters in Mexico provides vital backup to the work in Africa in the form of germplasm, methods, information systems, training, and administrative support. Despite the extremely challenging circumstances confronting agriculture and agricultural research in the region, CIMMYT and its partners have been able to make an impact (see fact sheet).

WHY AFRICA?

Maize and wheat are dietary mainstays of countless African producers and consumers. "Maize is life," say the farmers of Malawi, who rely on maize for food more than any other people on earth. Farmers in Ethiopia have depended on wheat to feed their families since antiquity, and wheat remains an important crop in that country today. These are two specific examples. Consider some of the overall numbers for maize and wheat:

- Maize accounts for more than 40% of total cereal production in sub-Saharan Africa.
- Africans use maize almost entirely to feed themselves. Eighty-five percent of the maize produced in eastern and southern Africa is used to feed people; in contrast, just 14% of the maize produced in the developed market economies is directly consumed by people.
- In eastern Africa, maize is the most important food staple. In Kenya and Tanzania, maize accounts for more than 60% of calorie consumption, and the importance of maize is still growing throughout the region.
- Maize is by far the dominant staple in southern Africa. Per capita consumption of maize in Malawi, Zimbabwe, Zambia, and Swaziland averages more than 100 kg per year.
- Given population growth, projected income growth, and other factors, demand for maize is likely to grow at 2.7% annually over 1993-2025 (IFPRI estimate, 1998). To meet this demand, maize production must increase at a faster rate. Yet between 1975 and 1995, yields of

maize in Africa grew at only one-third of the rate achieved in other regions of the developing world.

- Wheat is not as widespread as maize in sub-Saharan Africa, but it is important in eastern and southern Africa, where Ethiopia, Kenya, Tanzania, South Africa, Sudan, and Zimbabwe are the chief wheat-producing countries. Across eastern and southern Africa, about 2.7 M ha of wheat were harvested in 1993-95.
- Throughout Africa, wheat consumption has risen, and 90% of increased consumption in the past two decades has been provided by imports.
- Wheat consumption began rising at the same time that consumption of traditional staples was falling, indicating substantial substitution of wheat for these staples.
- Demand for wheat is projected to grow by 3.5% per year between 1993 and 2025—surpassing growth in demand for maize (IFPRI estimate, 1998).

AN INTEGRATED REGIONAL APPROACH

The preceding statements show why our mandate crops are critical for food security in sub-Saharan Africa. In its medium-term research plan, CIMMYT has included a regional project, "Improving Food Security in Sub-Saharan Africa," to focus its efforts in this important region. Through this project, we and our partners seek to:

- Develop and disseminate productive and efficient maize and wheat germplasm that possesses durable resistance to pests and diseases and is tolerant to environmental stresses.
- Develop and promote better crop production systems, suited to our clients' needs, focusing on soil fertility maintenance and water/pest management, while conserving natural resources and increasing productivity.
- Develop an understanding of natural resource dynamics (nutrient fluxes and system outputs) of maize- and wheat-based systems at the field, farm, and watershed level as input into sustainable land use management policy initiatives and future maize and wheat research strategies.
- Conduct economic and impact studies to formulate policy recommendations and research priorities for improved maize and wheat farming systems in sub-Saharan Africa, including gender and equity concerns.

FACETS OF OUR WORK IN AFRICA

The table indicates the range of collaborative activities undertaken to achieve the objectives described earlier (space does not allow us to list every activity). These

inter-related activities indicate our continued commitment to the three areas of research that are integral to alleviating poverty: germplasm, natural resources, and policy. They also indicate our considerable commitment to biotechnology research with partners in Africa.

RESEARCH FOCUS

ACTIVITY

Maize and wheat networking	Maize and Wheat Improvement Research Network (MWIRNET): to increase the productivity of resources committed to wheat and maize in the region, by promoting a spirit of cooperation; to sustain the productivity of germplasm resources through better resistance or tolerance to biotic and abiotic stresses (southern and eastern African countries)
Soil fertility	Soil Fertility Network for Smallholders' Maize-based Cropping Systems (SoilFertNet): to ensure continuity and support to national research programs and other organizations in long-term soil fertility research
Biotic and abiotic stress resistance/ tolerance in maize and wheat	<p>Developing and disseminating improved, locally adapted strains of maize with tolerance to drought and low soil nitrogen in southern Africa</p> <p>Developing and disseminating improved, locally adapted strains of maize with tolerance to various stresses in central, eastern, and western Africa</p> <p>Evaluating nitrogen-use-efficient maize and other maize genotypes under smallholder soils and management in Zimbabwe</p> <p>Developing and extending to farmers sustainable cropping systems that control <i>Striga</i> and improve maize production in western Kenya</p> <p>A regional nursery for evaluating resistance/tolerance of promising maize lines to endemic diseases and insect pests and verifying agronomic suitability</p> <p>Strengthening the capacity of national programs in eastern Africa to conduct wheat breeding and pathology research</p> <p>Developing near-isogenic lines for assessing the pathogenic variation in the wheat stripe rust pathogen</p>
Biotechnology research	<p>Mapping and marker-assisted selection of host plant genes resistant to insect pests (<i>Chilo</i>, <i>Busseola</i> spp.) of maize</p> <p>Developing and deploying transgenic insect resistance to <i>Chilo</i> spp., <i>Busseola</i> spp., and other lepidopteran pests of maize</p> <p>Screening teosinte, <i>Tripsacum</i> and maize accessions for resistance to <i>Striga</i> spp., identifying resistance genes, and developing molecular markers for them</p> <p>Mapping and marker-assisted selection of genes affecting tolerance to drought in maize</p> <p>Mapping maize host plant resistance to fungal pathogens (<i>Helminthosporium turcicum</i>)</p> <p>Mapping and marker-assisted selection of host plant genes for resistance to viral pathogens in maize (MSV, MMV)</p> <p>Mapping of teosinte- and <i>Tripsacum</i>-derived tolerance to the parasitic weed, <i>Striga</i></p> <p>Developing resistance to <i>Striga</i> through transposon mutagenesis of maize</p> <p>Developing low-dose herbicide seed treatments of herbicide-resistant maize for <i>Striga</i> control</p> <p>Mapping and marker-assisted selection of opaque-2 gene and its modifiers to improve quality protein maize</p> <p>Developing apomictic maize to enable poor farmers to avoid problems entailed by purchasing and recycling maize seed</p>
Building regional socioeconomics capacity	<p>Strengthening the capacity of social scientists in national research programs in eastern Africa to conduct economics and policy research</p> <p>Strengthening the capacity of social scientists in national research programs in southern Africa through collaborative research on the economics of maize and wheat production, technology development, and transfer (through MWIRNET)</p>
Highland maize	Developing maize germplasm for the highlands of eastern Africa
Risk management for maize farmers	Research incorporating soil and crop modeling, GIS, and farmer participatory research to improve risk management strategies in maize-based cropping systems
Crop production systems for maize and wheat	Developing methods for increasing sustainable maize and wheat production, thereby improving food security in eastern Africa



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IMPACT THROUGH COLLABORATION

These are the impacts we seek to achieve:

- An enhanced and stable supply of grain for food and seed, and reduced prices to consumers of maize and wheat products—both contributing to the well-being of rural and urban poor and to food security at the household, national, and regional levels.
- Reduced maize and wheat imports, with consequent benefits for national balances of trade and reduced dependence on international food aid.
- Diminished environmental degradation, as a result of the more efficient use of land, water, and other inputs.

LINKS WITH PARTNERS: SOME EXAMPLES

- Funding for collaborative research is directed to national programs through the activities listed in the table on the previous page. In many instances these research resources are allocated by steering committees composed of representatives from throughout the region. Additional grants from CIMMYT enable scientists from national programs to complete research projects despite limitations in funding at the national level.
- Regional conferences and workshops periodically assemble researchers, policy makers, and other members of the development community. For example, maize and wheat researchers hold regional workshops every two years, hosting more than 100 participants. These meetings are an important means of disseminating and documenting research results and of coordinating future activities.
- Special-focus workshops on topics of particular interest in the region (resource economics, crop modeling) expand the array of skills available to researchers.
- A strong effort has been made to institutionalize important kinds of capacity building in the region. In 1991, Egerton University (Kenya), the Kenya Agricultural Research Institute (KARI) and CIMMYT established a crop management research training course. Participants acquired practical knowledge rapidly and applied it immediately upon returning home. By 1997, 132 researchers from 16 African countries had been trained.
- The range of options for training in biotechnology (including support for visiting scientists at CIMMYT in Mexico) has steadily increased.
- Aside from proceedings, numerous publications, including articles in refereed journals of international importance, document the work of our collaborators in Africa.

- Much research and training occurs through networks (for example, the EU socioeconomics network and the *Striga* research network). Extensive contact with regional research organizations (e.g., the Southern African Centre for Cooperation in Agricultural Research) is a defining feature of our work in the region.

CIMMYT 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 over 50 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 currently comes from many sources, including governments and agencies of Australia, Austria, Bangladesh, Belgium, Bolivia, Brazil, Canada, China, Colombia, Denmark, France, Germany, India, Iran, Italy, Japan, the Republic of Korea, Mexico, the Netherlands, Norway, Pakistan, the Philippines, Portugal, South Africa, Spain, Sweden, Switzerland, Thailand, the United Kingdom, Uruguay, and the USA, along with (among others) Cornell University, the European Union, the Ford Foundation, Grains Research and Development Corporation, the Inter-American Development Bank, the International Development Research Centre, International Fund for Agricultural Development, Kellogg Foundation, Leverhulme Trust, Nippon Foundation, OPEC Fund for International Development, Rockefeller Foundation, Sasakawa Africa Association, Stanford University, Tropical Agriculture Research Center (Japan), UNDP, University of Wisconsin, and the World Bank.

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New Initiatives:

THE FOUNDATION OF FUTURE FOOD SECURITY

Part of doing something well is the vision to see what else must be done. We would like to extend the impact of current efforts through two sets of activities for which we are seeking additional resources.

The first is **improved seed security**. War, economic, instability, and natural disasters have cut off or threatened the access of millions of subsistence farmers to quality seed, making it difficult or impossible for them to grow their own food. In many countries of eastern and southern Africa, seed delivery mechanisms are nonexistent or have deteriorated. CIMMYT proposes to 1) develop a capacity for crisis response by creating stocks of superior maize varieties as basic seed for emergency seed aid, and 2) lay the foundation for future food security by collaborating with national programs, private and parastatal seed companies, farmers' seed cooperatives, and NGOs to ensure adequate stocks of foundation seed and provide training in maize seed production and distribution.

The second set of activities relates to **agricultural research training for sub-Saharan Africa**. Crop management researchers and extension agents are vital to developing and disseminating the technologies that will protect and improve the productivity of African farms. However, the methods and skills needed for this work are rarely taught in university programs. This project would enable the training center established at Egerton University, Kenya, to expand its course offerings and become firmly established as a regional center of excellence for agricultural research training.

CIMMYT

OFFICES AND INTERNATIONALLY RECRUITED STAFF IN AFRICA

CIMMYT

PO Box 5689

Addis Ababa, Ethiopia

Fax: (251-1) 611892

Email: w.mwangi@cgiar.org

Primary contact: Wilfred Mwangi

Staff: Wilfred Mwangi (Economist), Hugo Verkuijl (Economist), Thomas S. Payne (Wheat Breeder), Douglas G. Tanner (Wheat Agronomist), S. Twumasi-Afryie (Maize Breeder)

CIMMYT

PO Box 25171

Nairobi, Kenya

Fax: (254-2) 631499, 630164

Email: a.diallo@cgiar.org

Primary contact: Alpha Diallo

Staff: Alpha O. Diallo (Maize Breeder), Dennis Friesen (Agronomist), Fred Kanampiu (Postdoctoral Fellow)

CIMMYT

PO Box MP 163

Mount Pleasant

Harare, Zimbabwe

Fax: (263-4) 301327

Email: cimmyt-zimbabwe@cgiar.org

Primary contact: David Jewell

Staff: David Jewell (Maize Breeder), Marianne Bänziger (Maize Physiologist), Mulugetta Mekuria (Economist), Julien de Meyer (Postdoctoral Fellow, Maize Program), Kevin Pixley (Maize Breeder), Zondai Shumudzarira (Natural Resource Group Modeling Affiliate), George Varughese (Leader, MWIRNET), Christopher Vaughan (Postdoctoral Fellow, Natural Resources Group), Stephen Waddington (Maize Agronomist/Associate, Natural Resources Group), Batson Zambezi (Maize Breeder)

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IMPACTS IN BRIEF

CIMMYT and its partners – especially the national programs and the International Institute of Tropical Agriculture (IITA) – have made a significant impact in Africa. Without this effort, the challenge ahead of us would be even more sobering.

- More than 350 improved maize varieties were released in sub-Saharan Africa between 1966 and 1990. More than 40% of these varieties contain CIMMYT germplasm, and they are grown on more than 2 M ha.
- More than 330 African maize researchers have come to CIMMYT headquarters for training, and more than 225 visiting scientists from Africa have conducted collaborative research at CIMMYT headquarters. Under a current project, visiting researchers from Kenya and Zimbabwe will establish applied agricultural biotechnology programs in their own countries and develop locally adapted, stress-tolerant maize.
- Recently published maize seed industry studies highlight the institutional structures and policies needed to bring the benefits of research to farmers.
- Between 1966 and 1990, 150 CIMMYT-related wheat varieties were released in sub-Saharan Africa. About 0.5 M ha were sown to CIMMYT-related wheats in 1990.
- With its partners, CIMMYT has developed zero tillage systems and crop rotations to improve the productivity of wheat.
- A recently completed study of the impact of the Ghana Grains Development Project, a CIDA-sponsored effort in which CIMMYT participated, found that during 1997, modern varieties of maize were grown on 54% of Ghana's maize area; farmers applied fertilizer on more than 26% of Ghana's maize area (despite extremely high fertilizer prices); and just over 55% of Ghana's maize area was planted in rows (to produce better plant populations).
- More than 160 African wheat researchers from 20 countries have attended training courses at CIMMYT headquarters, and more than 90 visiting scientists from 15 countries have worked on longer-term projects at CIMMYT in Mexico. The successful regional effort to develop capacity in on-farm research has contributed to the impact of improved seed and crop management practices in the region. This capacity has also enabled researchers to contribute to the development of new methods for farmer participatory research.
- The Kenya Maize Data Base Project (MDBP), established in 1992 with the help of the Rockefeller Foundation, CIMMYT, and the US Agency for International Development, enabled scientists to use GIS technology to prioritize and evaluate maize research options more effectively, by taking into account such variables as climatic effects and the socioeconomic conditions of farmers. A new book published in collaboration with CABI highlights results of this research.