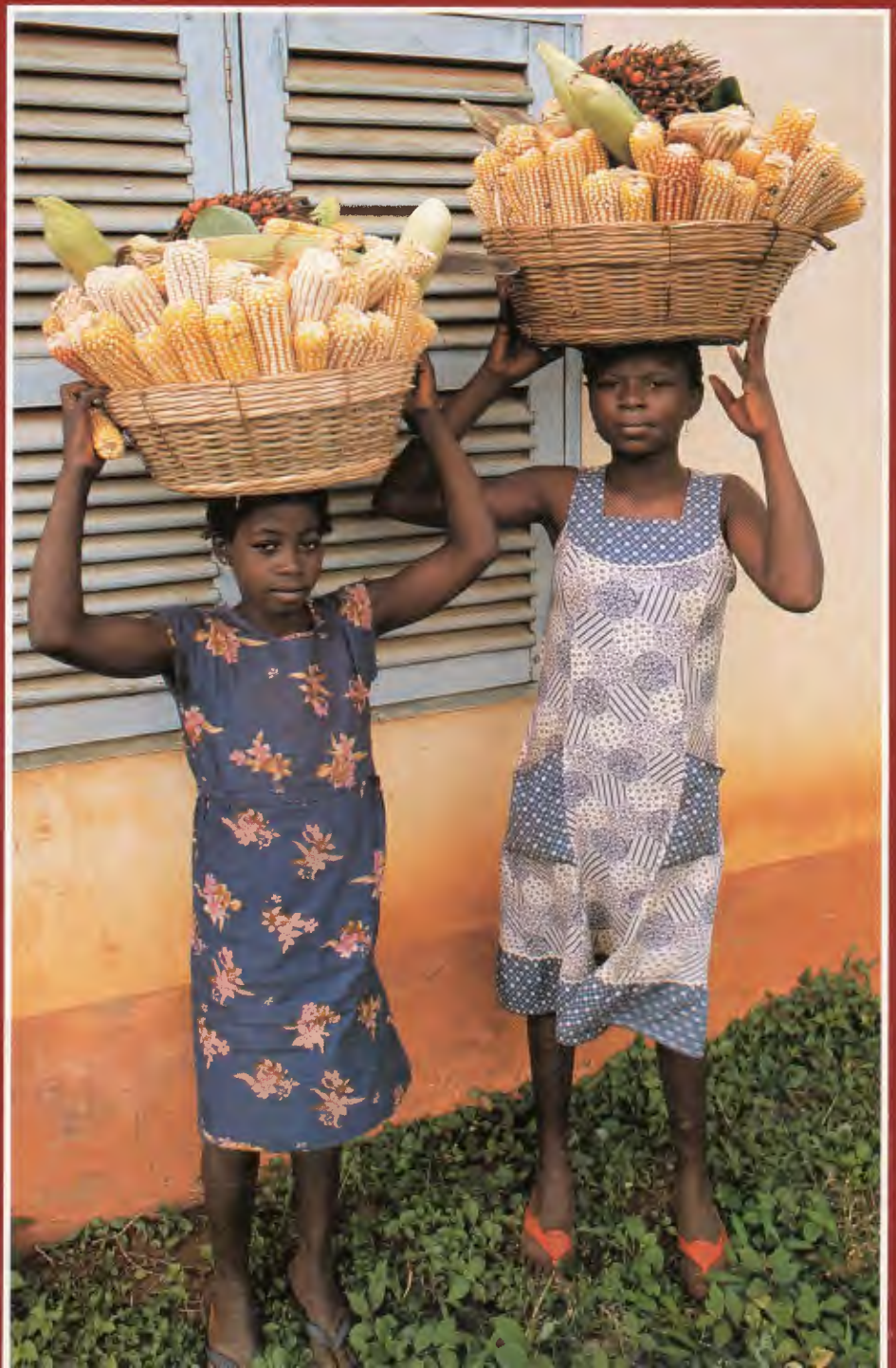
CIMMYT in 1992

Poverty, the Environment, and Population Growth:

The Way Forward



Poverty
Environmental decline
Rapid population growth

These problems affect virtually all developing countries, and through them, all humankind. CIMMYT's job is to produce new maize and wheat technologies that both increase agricultural productivity and protect natural resources. These technologies are born of innovative, long-term research and an awareness of farmers' needs. They promote economic growth, itself essential for dealing with the problems of poverty, the environment, and population growth. Our work strengthens the hand of agricultural researchers in developing countries; through them, farmers become more productive, as well as better guardians of the environment.

A Message from the Director General

With attention focused on the developing world's poverty, environment, and population growth, why should anyone be concerned about agricultural research? CIMMYT's 1992 report answers that question.

Changes in the international landscape present challenges and opportunities very different from those of only a decade ago. As the balances of global power have shifted, so too has the balance of development priorities. Issues of poverty, environmental decline, and rapid population growth are on the forefront. The idea that markets and the private sector can do many jobs better than the public sector is now widely accepted. And the rhythm of global growth has slowed, limiting resources for development.

The problems of poverty, environmental decline, and rapid population growth interact. Featured at the 1992 UN Conference on the Environment and Development in Rio de Janeiro and ever more prevalent in discussions about development, these problems are the defining development challenges of our time. We welcome the revitalization of concern over population growth and the urgency given to environmental problems affecting agriculture in developing countries. We believe, though, that poverty is the pivotal element in the nexus.

Poverty's toxic effects on the environment and the inability of poor countries to deal with those effects are treated in the pages that follow. We note, too, how poverty heightens the pace of population growth by limiting opportunities for women, assurances for old age, and the availability of education, family planning, and public health services. We also note the effects of population growth on the environment and on poverty, and the impact of environmental degradation on the poor.

We make the case that the way forward is through improved productivity in agriculture. Gains there stimulate broad-based economic growth, reduce poverty, lessen pressure on natural resources, and slow population growth. Historically, new agricultural technologies have been the major force driving improved productivity. Today, such technologies must also protect the natural resources upon which agriculture rests. These technological solutions will come from agricultural research, literally humankind's lifeline to the future.

CIMMYT's business is agricultural research. Our priorities rest on the urgent need to raise incomes in developing countries, on the role of improved agricultural productivity in achieving broader economic growth and in providing immediate benefits for the poor, on the critical part played by research in that process, and on the direct and indirect contributions of our work to protecting natural resources. These are the issues that drive our current work and our plans for the future, and the issues that animate this report.

As well, we recount some of our major achievements and activities for the year (pages 12-15). This is more a sampling than an exhaustive listing. Progress in other areas will be featured in future reports.

The section dealing with finance (pages 16-19) is cast in general terms. Specialists will want to request our Audited Financial Statement. We make the point that CIMMYT's resources have declined notably, restricting our ability to maintain the pace required to resolve the problems at hand.

Our aim in this report is to be brief and well focused, and to concentrate on the information needs of those who are stakeholders in CIMMYT. We trust you will find it informative and convincing.

J. Montalvo P. and E. Mendoza

Donald L. Winkelmann

Donald L. Winkelmann
Director General

Cover photo by
N. Russell

About CIMMYT

CIMMYT is an international agricultural research and training center, headquartered in Mexico but with offices in 15 other countries around the developing world. Our work focuses on wheat and maize, two of the top three commodities produced and consumed in developing countries. These crops rank a close second and third in both area and production, and together they account for one-quarter of the calories consumed in those countries. The poor, especially, rely on these crops for sustenance and, for poor farmers, they are a primary source of income. These grains fuel the "engine of growth" and, because they are so prominent in developing country diets, abundant supplies at low prices lubricate the growth process.

Early recognition of this importance led Mexico and the Rockefeller Foundation to begin a specialized research program on these and other crops in 1943; CIMMYT — founded in 1966 — traces its origins to that program. Success in developing high-yielding wheats enabled a quick response in the mid-1960s to the plight of the Asian Subcontinent, where widespread malnutrition and starvation threatened millions. The resulting Green Revolution earned the 1970 Nobel Peace Prize for Dr. Norman Borlaug, an early leader in the Center's wheat research.

Today, CIMMYT employs more than 100 scientific staff from 39 countries, and nearly 1,000 support staff. We have three major research programs — maize, wheat, and economics — all working toward a common mission:

To help the poor in developing countries by increasing the productivity of resources committed to maize and wheat while protecting natural resources.

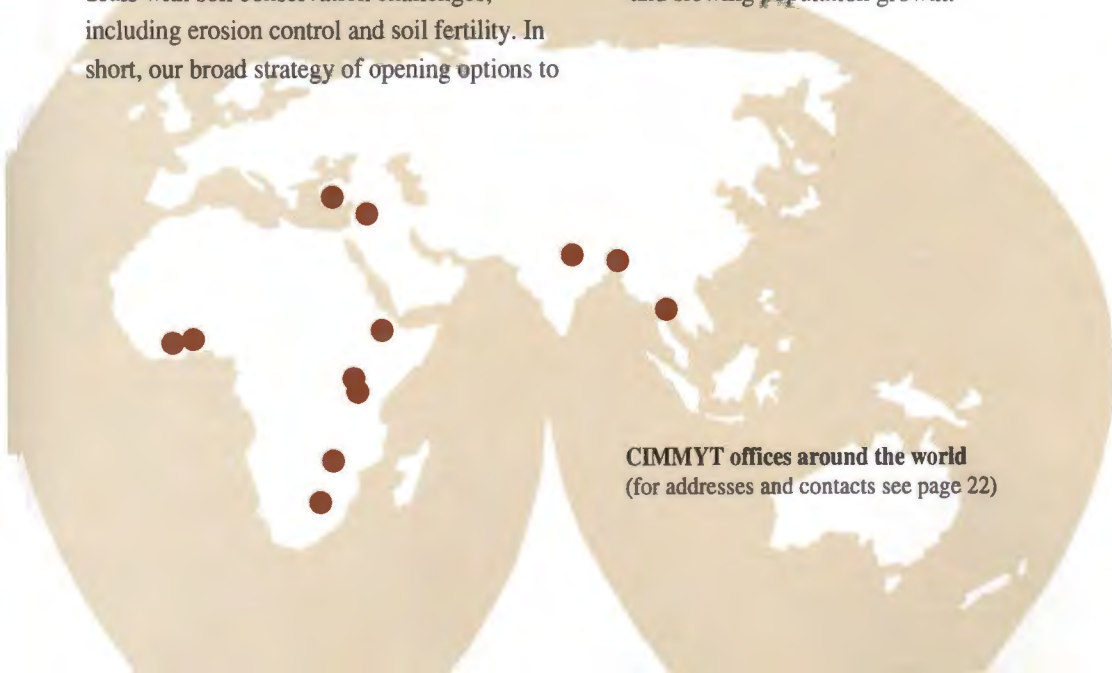
T. Luba

Our primary objective is to produce experimental maize and wheat varieties that our developing country partners — whether engaged in publicly or privately supported research — can use to increase farm-level productivity while protecting the environment. We distribute these varieties to more than 100 countries through our international testing and distribution networks. Collaborative research with dozens of advanced scientific institutions reinforces our efforts on behalf of the developing world's poor. In addition to producing improved varieties, our work generates new scientific knowledge and more effective research procedures. We maintain two of the world's largest collections of maize and wheat genetic resources, from which all can draw for research purposes. Finally, we support national agricultural research programs through training, various information services, and consulting.

CIMMYT's products and services have had extraordinary impact on the productivity of agriculture in developing countries (see column, far right). And by increasing the productivity of areas already being farmed, our work dramatically reduces the threat to fragile environments and forest margins. Pest-resistant varieties of maize and wheat reduce the need for environmentally dangerous chemicals, and our crop and natural resource management research deals with soil conservation challenges, including erosion control and soil fertility. In short, our broad strategy of opening options to the poor through agricultural research leads to higher productivity in agriculture, greater economic growth, and higher incomes, and, directly and indirectly, protects natural resources.

Primary financial support for CIMMYT's work comes from the Consultative Group on International Agricultural Research (CGIAR), a consortium of public and private agencies representing some 35 countries, international and regional organizations, and private foundations. Additional special project funding is provided by various investors from within the CGIAR (see Financial Highlights, pages 14-19).

The CGIAR was formed in 1971 with cosponsorship by the Food and Agriculture Organization (FAO) of the United Nations, the International Bank for Reconstruction and Development (World Bank), and the United Nations Development Programme (UNDP). This unique system is committed to improving the well-being of the poor in developing countries through the work of 18 international agricultural research centers. There is an emerging consensus among CGIAR members that such work — in close collaboration with national programs in developing countries — offers the best hope for progress toward alleviating poverty, protecting natural resources, and slowing population growth.



CIMMYT offices around the world
(for addresses and contacts see page 22)

Our Impact

50 million hectares in developing countries are planted to CIMMYT-related wheat varieties (70% of all the wheat area in the developing world, not including China)

Our wheats spread to 20 million additional hectares during the last decade alone, with millions more being sown to second- and third-generation improved varieties

13 million hectares of non-temperate maize area in developing countries are now sown to CIMMYT-related varieties (50% of the area devoted to improved varieties)

Our maize and wheat varieties account for well over US$ 1 billion in extra grain production each year

Over 4,500 researchers from around the world are alumni of CIMMYT's training programs

CIMMYT researchers have made numerous contributions to the advancement of agricultural science, ranging from developing practical research techniques to clarifying the genetic basis of disease resistance in maize and wheat

Our information products and networking improve the efficiency of researchers in over 100 countries

Poverty, the Environment, and Population Growth: *The Way Forward*

The quality of the human condition and hopes for a better future continue to be diminished in large parts of the world by a combination of poverty, malnutrition, demographic pressures, unemployment, lack of health care, wasteful uses of energy, pollution and degradation of air, water, and land resources.

—UNCED Guide to Agenda 21

N. Russell

The United Nations Conference on the Environment and Development (UNCED), held in Rio de Janeiro in June 1992, came at the end of months of intensive debate and negotiation on issues of profound importance to the welfare of our planet and all its inhabitants. The conference crystallized the idea that poverty, environmental decline, and rapid population growth are the defining development challenges of our day. They form a complex set of interrelated problems in which poverty — because it limits choices favorable to the environment and thwarts efforts to reduce population growth — is the pivotal element.

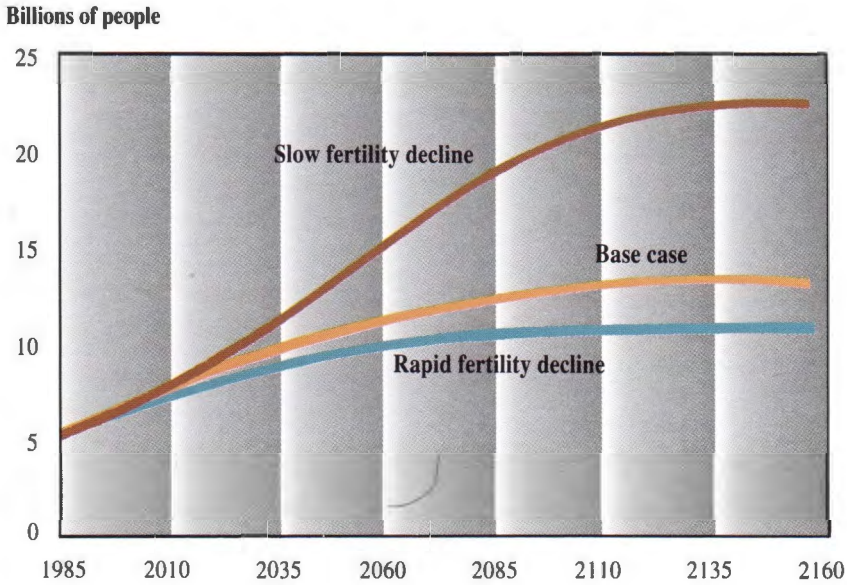
Today, over one billion people must meet their needs for food, clothing, and shelter with income equivalent to only one US dollar per day. Many must make do with even less. Such abject poverty is clearly toxic to the environment. In many rural areas the poor farm fragile lands and press on forest margins to produce food for a subsistence living. They are motivated by an urgent need to survive, and can pay little attention to near-term consequences for natural resources. Favored environments, too, are coming under increasing pressure, as farmers use ever more intensive production practices to meet growing demands for foodstuffs. The effects on soil quality — declining fertility, poor structure, micronutrient imbalances, and an increasing incidence of soil-borne diseases — are becoming more evident. In effect, farmers are mining their most precious resource. The resulting environmental impacts threaten the future of already poor countries.

Poverty also bears directly on population growth rates; as incomes rise, population growth rates decline. In poor families, more children still represent additional labor and eventual income security. And while education for women and improved health care can have a notable effect on family size, the ability of nations to offer their people education, family planning, and public health services — all of which are related to lower birth rates — depends on the availability of additional resources.

Although the global population growth rate is down to about 1.7% from its peak of 2.1% in the late 1960s, absolute growth — nearly 100 million people per year — is at an all-time high. During the next four decades, the World Bank estimates that global population will rise by nearly 4.0 billion people. Projections by others suggest more rapid growth; few indicate slower rates. All agree, however, that virtually all of this growth will take place in developing countries, those least able to cope with it. But whatever the projections, faster growth in incomes would bring lower population growth rates and, in the final analysis, leave us with a lower steady-state population.

The best prescription for slowing population growth is growth in per capita income, particularly among the poor, combined with the education and economic empowerment of women.

— World Resources Institute



This graph shows global population projections under different fertility trends. Faster income growth, coupled with other factors, will bring lower population growth rates and a lower steady-state population in the future.

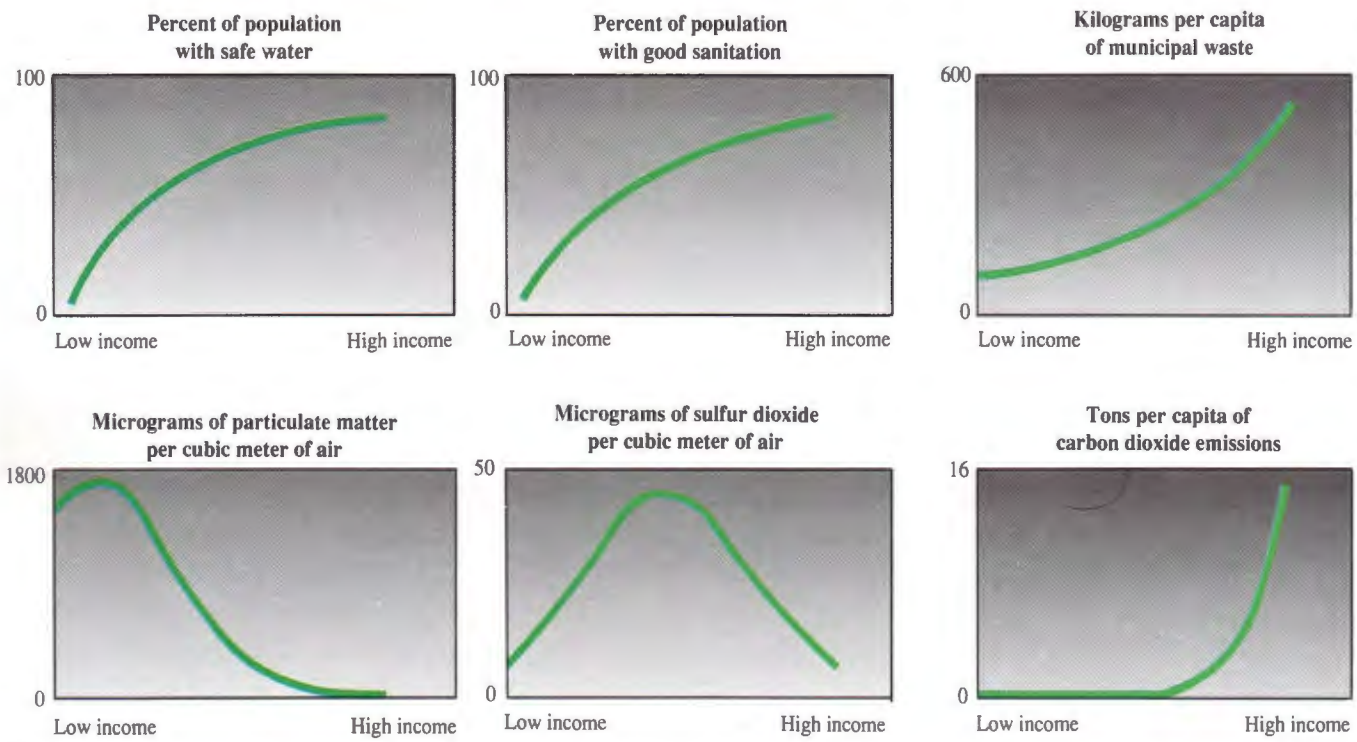
Source: *World Development Report, 1992*. International Bank for Reconstruction and Development/The World Bank, Washington, D.C., 1992, page 26.

Many believe that a more crowded world necessarily means more environmental degradation, and over the broad sweep of history this certainly has been the case. In the developing world, population growth is clearly associated with environmental decline. It is poverty, though, that is at the heart of the problem. Notice the trends of the last 50 years in developed countries. There, higher incomes have unleashed forces that favor a healing of the environment. The World Bank reports that, of six high priority environmental concerns, only two — municipal waste and carbon dioxide emissions — continue to rise as incomes grow. The others — polluted water, poor sanitation, and air pollution in the form of particulate matter and sulfur dioxide emissions — diminish as higher incomes provide the wherewithal for environmental protection. Beyond that, forest area in developed countries is increasing, wildlife numbers are moving upward, and fisheries are receiving more protection. Of course, tough measures are still required to ensure that these trends continue.

Whatever impact population growth has in richer nations is multiplied many times over in poor countries, where higher rates of population growth frustrate efforts to alleviate poverty. For example, even the limited investments in education and health services made by poor countries experiencing rapid population growth are inevitably divided among greater numbers of people, leaving each with less. Thus the problems of a more populous world and a less resilient environment lead directly back to poverty — the circumstance that engenders and exacerbates them.

Alleviating poverty is both a moral imperative and a prerequisite for environmental sustainability. The poor are both victims and agents of environmental damage.

— The World Bank



Key environmental quality indicators at different national income levels. Note that some indicators improve as incomes rise; others worsen. Some first worsen, then improve.

Adapted from: *World Development Report, 1992*. International Bank for Reconstruction and Development/The World Bank, Washington, D.C., 1992, page 11.

These closely intertwined development challenges emerge from poor countries, but affect all humankind. Poverty is the fulcrum; without economic growth to check poverty, environmental degradation and population growth will go unchecked.

The way forward is through agriculture. More specifically, we must raise agricultural productivity in developing countries through new technologies that both increase productivity and conserve natural resources. That in turn will lead to broad-based economic growth, less poverty, less pressure on natural resources, and slower population growth.

The links between higher productivity in agriculture and economic growth are direct. Farmers who are more productive earn higher incomes that, in addition to enhancing their own well-being, create an ever-widening demand for goods and services outside the agricultural sector — much like ripples on a still pond. A more productive agricultural sector also means more food at lower real prices. These lower prices facilitate the complex interactions that promote economic growth. The real income of the work force increases, especially where food accounts for a large part of household budgets, as it does in developing countries. A portion of this additional income is spent on non-food products, stimulating further rounds of demand and growth. A portion is also saved and reinvested, either in people or in physical capital, enabling still more growth in the future.

And how is it that incomes in agriculture can rise while food prices decline? This can only happen as a result of increases in productivity. Note that in India, during the 1970s and 1980s, yields of wheat rose rapidly with the advent of new technologies. The use of wheat increased in that period by two and a half times. Simultaneously the real price of wheat declined by about 40%, with hardly any imports. Only increased productivity could make this possible. And, while this was occurring, India's economic growth rate, some 3.6% in the 1970s, moved up to a notable 5.3% over the last decade. While many elements combined to increase the rate of economic growth, lower food prices clearly eased the process.

So, increased productivity in agriculture promotes economic growth in two ways. The poor, who spend large portions of their incomes on food, benefit immediately from lower food prices and, as the growth process continues, from the increased demand for labor outside agriculture.

Increased incomes will lessen pressure on natural resources. This environmental payoff will tend to come first in agriculture, as lower food prices and increased demand for labor — both on and off the farm — reduce the need to farm fragile lands and forest margins. The ability to bring other environmental problems associated with development under control, such as greenhouse gases and municipal wastes, will rise along with incomes.

Rising incomes will also open the way to lower rates of population growth. More secure livelihoods and access to education and health services, along with increasing opportunities for women, will lead to lower reproduction rates and slower population growth.

Agriculture has played a key role in the development of the now-rich nations and will be crucial to the development of those now poor.

— W.H. Murdoch,
The Poverty of Nations

Deliberate investment in agricultural research has never been more important. Yet expenditures for agricultural research are stagnating.

— The World Bank

Agricultural research has been a reliable source of productivity-increasing, resource-conserving technologies for many years. CIMMYT plant breeders, for example, have produced varieties of wheat and maize that are much more efficient in converting sunlight, moisture, and nutrients into grain. And not only that, whole new traits have been introduced, giving farmers new alternatives and again increasing the efficiency of resources used in agriculture.

The art and science of plant breeding have dramatically improved the lives of all people. But the research done by plant breeders also has impressive payoffs for the environment. Our efforts to improve the genetic resistance of maize and wheat to insect pests and plant diseases, for example, limits the need for farmers to apply pesticides, benefiting the environment at the same time that it provides poor farmers with higher and more stable yields.

So far, however, the more powerful environmental impact of CIMMYT's plant breeders has come from higher productivity in favored environments already being farmed. Our breeders' success there has significantly reduced the need to bring marginal lands into production. India again vividly illustrates this achievement (see column, far right). Until we know much more than we do now about how best to manage natural resources, these indirect payoffs will constitute the greatest contribution of agricultural research to protecting the environment. Even so, research focused directly on conserving natural resources is essential.

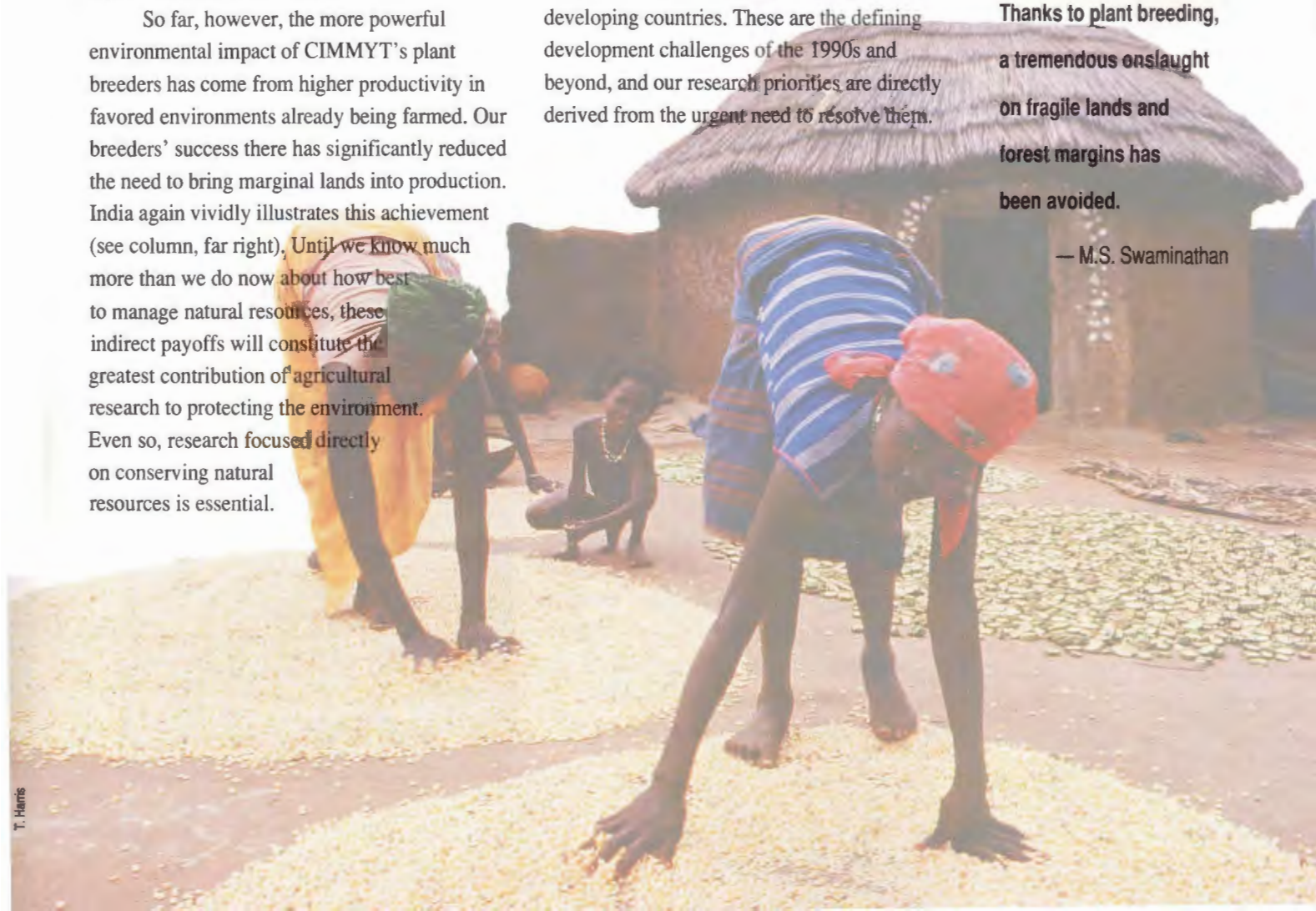
CIMMYT's strategy in this arena includes research aimed at protecting the soil and water resources used in agriculture. One example in favored environments is the now stressed rice/wheat-based production system of the Asian Subcontinent. And our research also covers the more evidently threatened ecologies, such as the erosion-prone hillside maize-based systems of Mexico and Central America.

The technologies required to raise productivity while conserving natural resources will come primarily from agricultural research, the domain of CIMMYT and other national and international research organizations. Non-governmental organizations, too, will help ensure the applicability of new technologies and bring pressure to bear so that important problems and opportunities are not overlooked.

CIMMYT offers an effective means for reducing poverty, protecting the environment and, indirectly, slowing population growth in developing countries. These are the defining development challenges of the 1990s and beyond, and our research priorities are directly derived from the urgent need to resolve them.

If India had to produce its current wheat harvest with the technologies of 25 years ago, farmers would have to bring more than 40 million *additional* hectares (nearly 100 million acres) of land of equal quality into production. More, actually, since most of the country's good land is already under the plow. Thanks to plant breeding, a tremendous onslaught on fragile lands and forest margins has been avoided.

— M.S. Swaminathan



T. Harris

1992 in Review

Achievements and Activities

Leaf rust at bay

CIMMYT researchers confirmed that many of our wheat varieties possess long-lasting genetic resistance to leaf rust, by far the most widespread and damaging disease affecting wheat today. Estimates of annual losses to developing country farmers reach into the millions of tons and hundreds of millions of US dollars. The *Wall Street Journal, der Spiegel, Los Angeles Times, Chicago Tribune,* and *Science* magazine, among some 150 other periodicals worldwide, carried reports in October of this success.

CIMMYT files

Brown leaf tips simplify breeding

Wheat staff established that a common trait in CIMMYT wheats — a characteristic browning of the leaf tips in the later stages of plant development — actually signals the presence of resistance to three major diseases. This trait will greatly simplify future breeding efforts.

Measuring CIMMYT's impact

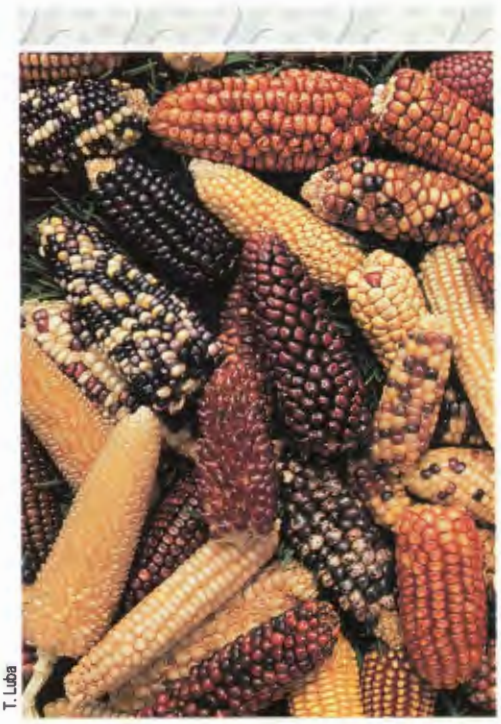
Economics Program staff carried forward an extensive study of the spread of CIMMYT-related wheat and maize varieties throughout the developing world. This work, done in close collaboration with colleagues in national research programs, generated much of the data on impact cited in this and other Center publications. A key feature of the study is that data are organized by year, allowing us to measure both our cumulative impact and the results of our efforts during selected time periods. Thus, we are now able to respond with accuracy to the question "What have you done for us lately?"

A lesson from the firefly

Borrowing the principle behind the firefly's glow, the Center's biotechnicians adapted a technique that uses chemically generated light instead of radioactive emissions to detect DNA markers. This method makes our work safer and less costly and holds considerable promise for laboratories in developing countries.

Rescuing native maize races

With funding from USAID and USDA, CIMMYT staff began work to help seed banks in Latin America rescue more than 7,000 endangered seed samples they hold of farmer-developed maize varieties. More than 1,000 samples were regenerated in 1992 by Latin American banks and placed in long-term storage. Collaborators keep their renewed samples; backups will be stored in the Center's bank and the National Seed Storage Laboratory, USA.



T. Lubba

Malawi hybrids

Mixing their own varieties and know-how with CIMMYT seed and technical assistance, maize breeders in Malawi have developed a pair of hybrids that farmers find similar to cherished local varieties in grain texture and storage quality, but which yield much more. Some 70 farmers recently tested one of the new hybrids in their fields, with very positive results. A comment by one: "You have given us back the local maize we used to grow."

Nitrogen-efficient wheat

Experiments in 1992 demonstrated that our breeders have significantly improved the ability of bread wheats to extract nitrogen from the soil and convert it to grain. Over time, yields have increased at all levels of nitrogen application. Even when no fertilizer is applied, newer varieties yield more than older ones. These findings support past studies showing that CIMMYT bread wheats provide higher yields to all farmers, whether or not they can afford to apply nitrogen fertilizer.

Mucuna and maize: a winning combination

CIMMYT social scientists worked with national research programs and non-government organizations in Central America and Mexico to explore benefits from the use of green manures in hillside maize fields. Green manures are legume plants that help control erosion and weeds, conserve soil moisture, and improve soil fertility. Honduran farmers who have experimented with combinations of maize and one such legume, named mucuna, are so impressed with the results that one said mucuna "makes cowardly land become brave again."

Making bread from triticale

Triticale, a grain developed by crossing wheat with rye, often yields more than wheat in the face of disease, drought, and poor soils. Despite this yield advantage and the grain's increasing use in animal feeds, it has yet to gain broad acceptance as a source of human food, mainly because triticale doughs are not well suited to mechanical mixing. Recently, however, a US collaborator replaced certain rye genes in triticale thought to be the source of the quality problem with genes from bread wheat that are associated with high breadmaking quality. In 1992, our scientists crossed CIMMYT's best triticales with the transformed variety, and will determine in the coming months whether improved breadmaking quality is being achieved.

T. Harris

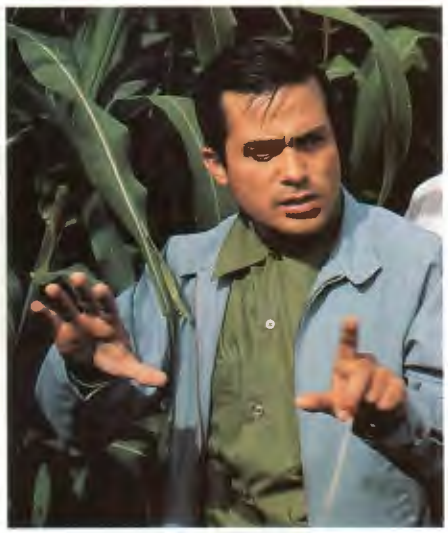
Support to hybrid maize breeders

As a result of its increased emphasis on research related to hybrids, our Maize Program made nearly 100 elite inbred lines available to developing country researchers. These lines, which can be used to develop hybrids, include strains that fit either lowland tropical or midaltitude environments and possess resistance to maize streak virus, an important production constraint in sub-Saharan Africa.

Cool canopies/more grain

Our wheat researchers have determined that cooler crop canopies — a condition resulting from increased transpiration when the weather gets hot — appear to be associated with more photosynthetic activity and higher yields. Because temperatures of the upper leaves can be measured instantly with a hand-held, infrared thermometer, this yield/temperature relationship should speed the identification of wheats with better potential for warm areas.

Staff News

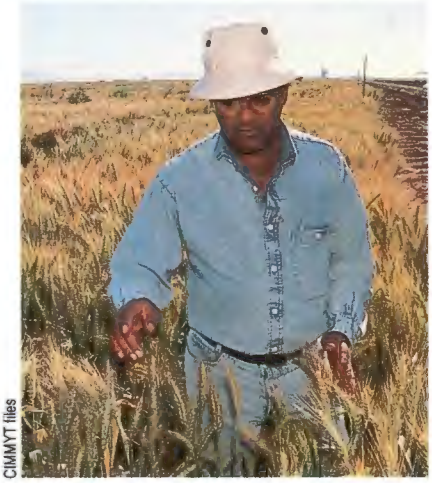


CIMMYT files

Carlos De León (maize breeder) received from China the distinguished medal and certificate of friendship — the only such award given that year in agricultural sciences — for CIMMYT's work with the Yunnan Academy of Agricultural Sciences and other maize programs in southern China. He was among 40 recipients chosen from several thousand nominees.

A 1992 CIMMYT-imprimatur manual, *Rust Diseases of Wheat: Concepts and Methods of Disease Management*, won first place in the 1993 Agricultural Communicators in Education Critique and Awards Program, category of technical publications. The publication was co-authored by **Alan Roelfs** (University of Minnesota) and CIMMYT pathologists **Ravi Singh** and **Gene Saari**; it was edited by **Gene Hettel** and **Alma McNab** and designed by **Miguel Mellado E.**

Sanjaya Rajaram (wheat breeder) was accorded two prestigious honors for his many contributions to agricultural research and development: the 1992 International Agronomy Award from the American Society of Agronomy and the 1992 International Service in Crop Science Award from the Crop Science Society of America.



CIMMYT files

CIMMYT staff mourned the death last September of an inspiring leader and communicator in agricultural development, **Haldore Hanson**, the Center's second Director General (1972-78). Haldore brought diverse talents to bear on the challenges facing CIMMYT during his tenure. He brought, as well, kindness, enthusiasm, energy, and a positive outlook to all his endeavors. He will be missed.

CIMMYT files

Meetings and Reviews

CIMMYT presented its Medium-Term Plan and Budget, 1994-98, to the CGIAR at International Centers Week in Washington, D.C. In addition to summarizing plans and notable achievements, two themes were emphasized: how the work of the Center relates to reducing poverty, protecting the environment, and slowing population growth; and the Center's role in research on natural resource management.

More than 50 scientists representing public and private institutions in 15 countries received up-to-date reports on progress in wheat genome mapping at the meeting of the International Triticeae Mapping Initiative (ITMI), held at CIMMYT headquarters.

Some 40 agricultural information specialists from more than a dozen major Mexican institutions took part in a CIMMYT workshop to promote the exchange of information and participation in AGRIS, an international information system coordinated by FAO.

Twenty-five Rockefeller Foundation social science fellows gathered at CIMMYT to present results of their research — which focuses on issues ranging from natural resource management to nutrition to geographical information systems — and to discuss the role of social scientists in international agricultural research centers.

CIMMYT coordinated reviews by panels of outside experts on five of its major research areas, including maize international testing, wheat genetic resources, and a joint project between CIMMYT and the French National Research Institute for Development in Cooperation (ORSTOM) to collect, evaluate, and use *Tripsacum*, a maize wild relative, in maize improvement. On the latter, for example, reviewers were pleased by progress toward obtaining maize that reproduces asexually, meaning that farmers could eventually save seed from one season for planting in the next without losing its improved traits.

J.L. Castillo

Visitors to CIMMYT

Mr. **Visvanathan Rajagopalan**, a Senior Vice President of the World Bank and Chairman of the CGIAR, spent two days in July at CIMMYT headquarters to familiarize himself with the Center's overall objectives and program of work.

The Minister of Agriculture, The Netherlands, Mr. **Pieter Bukman**, visited in May to discuss CIMMYT contributions to sustainable agriculture and the conservation of maize and wheat genetic resources.

CIMMYT research and funding were the topics of interest for Drs. **Uwe Holtz** and **Harald Schreiber** and Ms. **Verena Ingeburg Wohlleben**, members of the German Parliament's Committee for Economic Cooperation, accompanied by German Ambassador **Peter Dingens** and Mr. **Michael Zenner**, Economic and Commercial Consul of the German Embassy in Mexico, all of whom visited headquarters in March.

Influential non-governmental organization spokesman, Mr. **Pat R. Mooney**, Professor **John Barton**, Stanford Law School, and Dr. **Ramón García**, InterLink (a private US biotechnology company), participated in a seminar series on intellectual property protection and its significance for CIMMYT and our partners in research.

Dr. **Didier Picard,** Director, Department of Annual Crops, CIRAD, France, headed a group of French research administrators attending meetings involving CIMMYT and the three major French research institutes.

Dr. **Nobou Murata**, Director of the Eco-Physiology Division, TARC, Ministry of Agriculture, Forestry, and Fisheries, Japan, visited headquarters in September to discuss opportunities for collaborative wheat research.

Dr. **V.L. Chopra**, Director General of the Indian Council of Agricultural Research (ICAR), New Delhi, was part of an expert panel that reviewed the wheat genetic resources subprogram in September.

CIMMYT receives literally hundreds of visitors each year from all over the globe. They come for many reasons, but in all cases we benefit from their interest and insights. From among the many distinguished individuals and groups who visited in 1992, we have space here to mention only a few.

Financial Highlights

Since the late 1980s, CIMMYT has changed its allocation of resources among major enterprises and activities. These changes, as well as our strategies for the future (see page 24), are based on the emerging needs of national programs and developing country farmers; a growing consensus on our role in dealing with the problems of poverty, the environment, and population growth; our sense of new opportunities; and on new budget realities.

We are using ever more imaginative ways to identify where our advantage lies, to set priorities, to choose our science, and to work with national programs. To enhance these efforts, we have implemented a number of measures aimed at improving efficiency and reducing costs. To offset recent reductions in national support staff, we are upgrading the skills of those who remain. These investments, as well as incentives for staff participation in efforts to reduce costs and improve operational efficiency, are paying dividends. As but one example, innovations proposed by staff — through our new "Ideas Program" — saved the Center some US$ 60,000 in 1992.

Balance sheet (US$ 000s)

	Year ended 31 December 1992	1991
Assets		
Cash and short-term deposits	3,516	1,321
Accounts receivable		
Donors	4,624	7,122
Other	1,404	1,247
Inventories	200	152
Prepaid fixed assets	570	430
Property plant, and equipment	26,137	25,022
Accummulated depreciation	(14,100)	(12,834)
Work in progress	76	0
Total Assets	22,427	22,460
Liabilities and Fund Balances		
Liabilities		
Accounts payable and other liabilities	2,156	1,875
Accrued staff obligations	700	818
Payments in advance from donors	2,966	2,859
Total Liabilities	5,822	5,552
Fund Balances		
Property, plant, and equipment	12,037	12,188
Capital fund	374	264
Subtotal	12,411	12,452
Other Funds	3,799	3,965
Operating	2,765	2,765
Auxiliary services	144	234
Cumulative translation effect	(2,514)	(2,508)
Subtotal	4,194	4,456
Total Fund Balances	16,605	16,908
Total Liabilities and Fund Balances	**22,427**	**22,460**

Like most other CGIAR centers, CIMMYT has been adversely affected by a general decline in the availability of funds for agricultural research. That decline reflects the global economic downturn that began in the late 1980s, as well as shifting priorities in development assistance agencies. While our close attention to improving operational efficiency has helped the Center remain highly productive even as real resources have declined, our new budget realities have led to a reduction in force of more than 15% since 1990. Our core-funded international staff and our Mexican support staff have been affected in roughly equal proportions.

CIMMYT's downsizing has been guided by priorities established in its strategic plan. Some work, such as applied crop management research, has declined notably; some, such as quality protein maize research, has been eliminated. In other cases, such as germplasm improvement, allocations relative to other activities in CIMMYT have risen. Still other research areas, such as biotechnology, have grown in both absolute and relative terms.

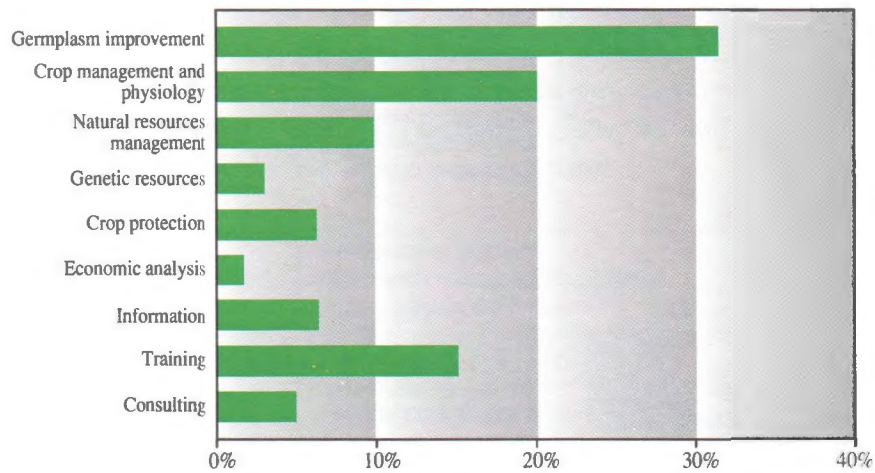
CIMMYT's spending reached US$ 33.7 million in 1992. Some $26.6 million were spent on essential work, $6.2 million on complementary efforts, and $0.9 million on auxiliary services. These allocations were derived from $25.7 million in core funding, $6.5 million in complementary funding, $0.8 million in auxiliary services revenues, $0.4 million from interest and other income, as well as $0.3 million from prior-year unexpended funds.

During the year, the Center's total assets decreased. Compared with 1991, total costs decreased slightly. Cash plus short-term deposits and accounts receivable were down notably. Liabilities increased moderately.

In 1992, we received funds for essential and complementary work from 33 sources (see table). Investor pledges in currencies other than US dollars are recorded at their dollar equivalence on the date of deposit. In 1992, the strength of the dollar against major currencies resulted in lower than expected dollar revenues from funds denominated in other currencies. In Mexico, the effect of an 11.6% dollar-denominated inflation rate continued to erode the purchasing power of dollar revenues received by the Center.

For detailed information on CIMMYT's financial circumstances, see our Audited Financial Statement (published separately). Copies are available from our Publications Office in Mexico.

Resource allocation by activity (% of total spending*)



* Excludes research support and administration/operations.

Sources of income (US$ 000s) from grants from 1 January to 31 December, 1992

	Core		Extra Core and	Total
	Unrestricted	Restricted	Cooperative	
Australia	684		29	713
Austria	225			225
Belgium	119	112		231
BMZ, Germany	515			515
Canada	1,509		2,952	4,461
Denmark	782		59	841
European Economic Community	2,276			2,276
Finland			58	58
France		467	8	475
Hohenheim, University of			15	15
India	50			50
Inter-American Development Bank	1,510	578		2,088
International Board for Plant Genetic Resources			117	117
International Crops Research Institute for the Semi-Arid Tropics			224	224
Islamic Republic of Iran			78	78
Italy		146		146
Japan		2,377	179	2,556
Norwegian Agency for International Development	228		39	267
OPEC Fund for International Development		47		47
People's Republic of China	80			80
Republic of Korea	60			60
Sasakawa Africa Association			30	30
Spain	100			100
Switzerland		280	338	618
The Ford Foundation	100		36	136
The Netherlands		162	122	284
The Philippines	43			43
The Rockefeller Foundation			312	312
The United Kingdom	1,208		13	1,221
The World Bank	5,318			5,318
United Nations Development Programme		1,971	38	2,009
United States of America	5,600		957	6,557
Miscellaneous Training and Research Grants			39	39
Total Income from Grants	**20,407**	**6,140**	**5,643**	**32,190**

Some of our funds derived from grants are earmarked by investors who have interest in a specific area of research. A cross-section of these projects is presented here to reflect the breadth and variety of CIMMYT's efforts. All funding is expressed in US dollars.

Australia

Boron Deficiency in Cereals
Acquire knowledge on the problem of boron deficiency in wheat in South and Southeast Asia.
Funding period: 1990-1992
Total pledge: $100,000
1992 Expenditures: $29,000

Belgium

Bacterial Diseases in Wheat
Support a Belgian associate scientist to conduct work on the major bacteria diseases of wheat.
Funding period: 1990-1992
Total pledge: $714,000
1992 Expenditures: $112,000

Canada

Ghana Maize Project, Phase III
Increase the productivity of resource-poor maize and legume farmers in Ghana.
Funding period: 1990-1995
Total pledge: $7.04 million
1992 Expenditures: $1.34 million

East Africa Cereals Program, Phase II
Increase maize, wheat, and triticale production and productivity in the East Africa region.
Funding period: 1988-1992
Total pledge: $4.05 million
1992 Expenditures: $410,000

East Africa Cereals Program, Phase III
Increase national research capabilities in East Africa while developing and introducing improved production technology through national research programs.
Funding period: 1992-1997
Total pledge: $3.83 million
1992 Expenditures: $323,000

Bangladesh Wheat Project, Phase II
Improve food security and alleviate poverty in Bangladesh by increasing wheat productivity.
Funding period: 1991-1995
Total pledge: $1.48 million
1992 Expenditures: $510,000

Denmark

Wheat Information Project
Support a Danish associate scientist to develop an integrated wheat information system for the Wheat Program.
Funding period: 1989-1993
Total pledge: $236,000
1992 Expenditures: $59,000

Finland

Wheat Genetic Resources Project
Support a Finnish associate scientist to conduct work in the area of tissue culture for triticale improvement.
Funding period: 1989-1992
Total pledge: $271,000
1992 Expenditures: $58,000

France

***Tripsacum* Research Project**
Support a team of visiting scientists from the French National Institute for Development and Cooperation (ORSTOM) to gather and evaluate accessions of *Tripsacum*, a wild relative of maize, for use in maize improvement.
Funding period: 1989-1992
Total pledge: $70,000
1992 Expenditures: $8,000

Islamic Rep. of Iran

Improvement of Maize and Wheat
Enhance development of maize and wheat, using the best available varieties, technology, and training.
Funding period: 1989-1993
Total pledge: $482,000
1992 Expenditures: $78,000

Italy

Barley Yellow Dwarf Virus, Phase II
Support transfer of technology from developed country institutions to developing countries to reduce crop losses caused by BYDV.
Funding period: 1988-1992
Total pledge: $1.17 million
1992 Expenditures: $146,000

Japan

Training Fellowships
Identify and support former CIMMYT trainees who have the capacity to earn advanced university degrees in various disciplines. Since 1986, 42 fellowships have been awarded.
Funding period: 1986-1993
Total pledge: $1.33 million
1992 Expenditures: $173,000

Norway

Training in Wheat and Maize
Support short-term visiting scientists at CIMMYT, Mexico; emphasis on scientists from South Asia and East Africa.
Funding period: 1988-1993
Total pledge: $303,000
1992 Expenditures: $39,000

Switzerland

Maize and Economics Research
Strengthen national program capacity to conduct maize improvement and economics research in Central America and the Caribbean, particularly to aid small farmers.
Funding period: 1992-1994
Total pledge: $1.12 million
1992 Expenditures: $281,000

Wheat Disease Research
Support a Swiss pre-doctoral fellow to study the epidemiology of wheat diseases in the rice-wheat cropping system of the Nepalese terai.
Funding period: 1990-1993
Total pledge: $154,000
1992 Expenditures: $39,000

The Netherlands

Disease Resistance Research
Study durable yellow rust and stripe rust resistance in wheat. Collaborative work with the University of Wageningen, Ethiopia, and Ecuador.
Funding period: 1989-1994
Total pledge: $1 million
1992 Expenditures: $27,000

RFLP Research
Develop a linkage map for wheat and an RFLP Network for maize. Collaboration with the University of Missouri and Cornell University.
Funding period: 1989-1993
Total pledge: $700,000
1992 Expenditures: $95,000

United Kingdom

Crop Management Physiology Research
Investigate the feasibility of introducing genetic material from wheat's wild ancestors to increase photosynthetic efficiency and yield potential of bread wheat.
Funding period: 1992-1993
Total pledge: $29,000
1992 Expenditures: $13,000

United States

Africa Farming Systems Research, Phase II
Provide technical assistance and training in farming systems research and on-farm research methodology to national agricultural research and extension institutions in eastern and southern Africa.
Funding period: 1986-1992
Total pledge: $6.57 million
1992 Expenditures: $764,000

Maize Genetic Resources Project
Regenerate maize accessions stored in national germplasm banks in Latin America and the Caribbean.
Funding period: 1991-1994
Total pledge: $320,000
1992 Expenditures: $80,000

Maize Genetic Resources Project
Regenerate maize landrace collections in Central and South America.
Funding period: 1991-1996
Total pledge: $160,000
1992 Expenditures: $20,000

Wheat Crop Management Research
Investigate management aspects of the rice-wheat cropping system in Nepal.
Funding period: 1992-1993
Total pledge: $150,000
1992 Expenditures: $28,000

The Ford Foundation

Sustainable Agricultural Development
Support regional training and research programs in sustainable agricultural development in Central America, the Caribbean, and Mexico.
Funding period: 1991-1993
Total pledge: $236,000
1992 Expenditures: $36,000

Inter-American Development Bank

Maize Varieties for Acid Soils
Develop maize varieties that are tolerant to acid soils and which enable immediate yield increases on some 2 million hectares of Latin American maize lands.
Funding period: 1990-1994
Total pledge: $2.03 million
1992 Expenditures: $232,000

OPEC Fund for International Development

Streak Resistance in Maize
Support research to improve lowland tropical maize germplasm for streak resistance in West Africa.
Funding period: 1991-1992
Total pledge: $60,000
1992 Expenditures: $47,000

The Rockefeller Foundation

Maize Research in Malawi
Analysis of maize varietal preferences and maize farming systems in Malawi.
Funding period: 1989-1993
Total pledge: $300,000
1992 Expenditures: $119,000

Social Science Research
Support a social science research fellow to conduct research on the socioeconomic dimensions of the adoption of soil conservation practices by maize farmers in Mexico and Central America.
Funding period: 1989-1992
Total pledge: $94,000
1992 Expenditures: $29,000

Maize Database
Build a maize database to guide maize research priorities in Kenya. Collaborative project with the Kenyan Agricultural Research Institute and USAID.
Funding period: 1992-1994
Total pledge: $160,000
1992 Expenditures: $65,000

UNDP

Stress Resistance in Maize Genetic Resources
Develop source germplasm that possesses resistance or tolerance to major constraints of maize production in developing countries such as insect pests, drought, and low nitrogen soils.
Funding period: 1990-1995
Total pledge: $6.6 million
1992 Expenditures: $1.03 million

Wheat in Warmer and Stressed Environments
Support activities in breeding, agronomy, and the physiology of heat tolerance to increase wheat productivity in warmer-area developing countries where biological and economic prospects for wheat are good.
Funding period: 1990-1993
Total pledge: $3.4 million
1992 Expenditures: $940,000

Trustees and Principal Contacts

(as of March, 1993)

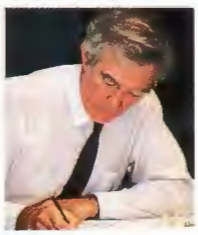
In 1992, four CIMMYT Trustees completed their six-year terms on the Board. Our sincere thanks to Drs. Peter Day (UK), Seme Debela (Ethiopia), Ahmed Goueli (Egypt), and Hikoyuki Yamaguchi (Japan) for their many invaluable contributions.

We welcome Drs. Boniface Ndimande (Zimbabwe) and Hirofumi Uchimiya (Japan), appointed by the Board of Trustees in early 1993. Dr. Ndimande is a plant pathologist and serves as Zimbabwe's Permanent Secretary of the Ministry of Lands, Agriculture, and Water Development. Dr. Uchimiya is professor of biosynthesis at the University of Tokyo's Institute of Applied Microbiology. The scientific expertise and practical experience of Drs. Ndimande and Uchimiya will maintain the effectiveness of CIMMYT's Board in guiding the Center's future research program and management efforts.

Trustees

Burton C. Matthews, Chairman of the Board and Executive and Finance Committee, (Canada), University of Waterloo

Donald N. Duvick, Chairman, Program Committee, (USA), Iowa State University



Lloyd T. Evans (Australia), Commonwealth Scientific and Industrial Research Organization

Khem Singh Gill (India), Punjab Agricultural University

Carlos Hank González (Mexico),[1] Secretary of Agriculture and Water Resources

Gao Liangzhi (China), Jiangsu Academy of Agricultural Sciences

Ricardo Magnavaca (Brazil), Brazilian Agency for Agricultural Research (EMBRAPA)

Ramón Martínez Parra (Mexico),[1] National Institute of Forestry, Agriculture, and Livestock Research

Edgardo Moscardi (Argentina), Interamerican Institute of Cooperation for Agriculture, Colombia

Boniface N. Ndimande (Zimbabwe), Ministry of Lands, Agriculture, and Water Development

W. Gerhard Pollmer (Germany), Hohenheim University

Dolores Ramirez (The Philippines), Institute of Plant Breeding, University of the Philippines

Ernesto Samayoa Armienta (Mexico),[1] National Institute of Forestry, Agriculture, and Livestock Research

Hirofumi Uchimiya (Japan), Institute of Applied Microbiology, University of Tokyo

Louisa van Vloten-Doting (The Netherlands), Department of Agriculture, Ministry of Agriculture, Nature Management and Fisheries

Donald L. Winkelmann (USA),[1] CIMMYT, Mexico

[1] *Ex officio* position

A significant change in our senior management was the retirement in January 1993 of Dr. Ripusudan Paliwal, Director of the Maize Program, and the arrival of Dr. Delbert Hess, a former vice president of International Seed, Cargill. We thank Dr. Paliwal for his many significant contributions during more than 17 years of dedicated service. We will miss his counsel and friendship. We welcome Dr. Hess, who was selected as the new Director after an intensive and wide-ranging international search. Dr. Hess brings a broad array of management and scientific skills to his new position that will serve CIMMYT and the Maize Program's clients well in the coming years.

The following is but a partial listing of CIMMYT staff, including the primary contacts at our headquarters in Mexico and in our offices around the world (page 22). A complete staff list, published separately, is available from our Publications Office.

CIMMYT Directors

Director General
Donald L. Winkelmann, USA

Deputy DG/Research
Roger Rowe, USA

Deputy DG/Administration and Finance
Claudio Cafati, Chile

Director, Maize Program
Delbert Hess, USA

Associate Director, Maize Program
Richard Wedderburn, Barbados

Director, Wheat Program
R.A. Fischer, Australia

Associate Director, Wheat Program
George Varughese, India

Director, Economics Program
Derek Byerlee, Australia

Assistant Director, Economics Program
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Seed Health
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Training Coordination
Gilberto Hernández V., Mexico

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Linda Ainsworth, USA

How to Contact CIMMYT's Offices

CIMMYT collaborates with researchers located in over 100 countries worldwide. To sustain our global reach, we maintain offices in 15 countries other than Mexico. In each office, there is a primary contact person who can either handle requests personally or channel them to the appropriate individual(s).

To reach CIMMYT directors, research subprogram leaders, and the other primary contacts listed on pages 20-21, use the following:

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Publishing by CIMMYT Staff

During the past five years, we have altered the form and direction of CIMMYT's publishing efforts. Considerably more emphasis is now given to publishing technical material and to public awareness work. While these efforts share the common objective of informing more people about our activities, specific audiences and products differ notably.

The increase in technical publishing is best reflected in a dramatic rise in contributions by CIMMYT staff to the scientific literature via refereed journals, books, and book chapters. This is the result of a deliberate change in the Center's information strategy. The payoffs of this effort include more dynamic professional interaction with agricultural research colleagues, the application of more effective science in CIMMYT, stronger credentials for our research staff, and greater visibility of the Center's research within the scientific community. Some 74 refereed journal articles, books, and book chapters were published in 1992.

Technical publishing also takes the form of CIMMYT-imprimatur research monographs, bulletins, working papers, special reports, manuals, and guidebooks. The Center has maintained a steady stream of relevant materials over the years, most of which are designed to strengthen the research capabilities of colleagues in developing country research programs. In 1992, more than 40 titles containing technical information were produced under the CIMMYT imprimatur.

For general information and for copies of publications mentioned in this report, contact:

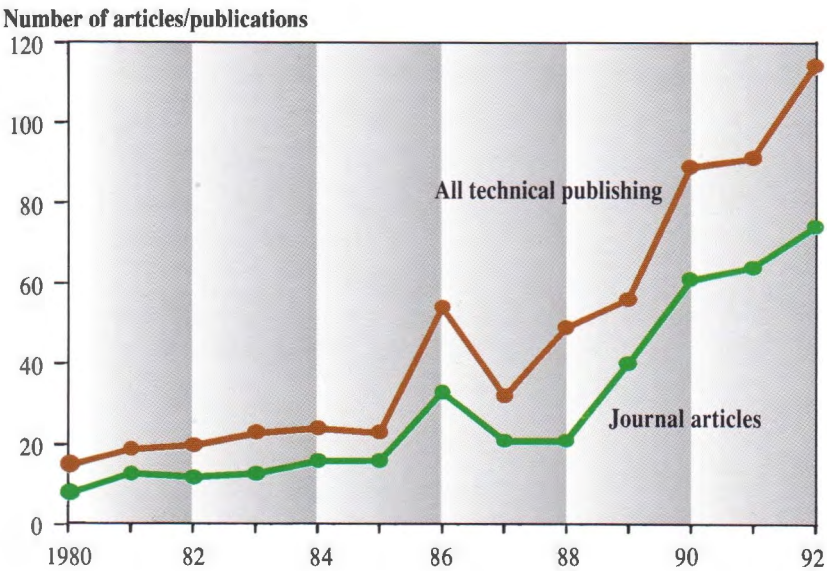
CIMMYT Publications Office
Apdo. Postal 6-641
Delegacion Cuauhtemoc
06600 Mexico, D.F.

In addition, our staff generally make numerous conference presentations about their work, and 1992 was no exception. A complete list of these presentations, and of all other Center publishing efforts in 1992, is available from the Publications Office.

Public awareness work promotes a broader recognition of the Center's continuing impact on development, as well as a better understanding within CIMMYT of how others see us. We now systematically prepare and distribute nontechnical information about our activities, emphasizing the nature of the work, why it is important, whom it will help, and when it will do so.

The primary objective of this work is to be more accountable to investors. We make every effort to ensure that they know their investments in CIMMYT are well placed, and that through our work they are making progress toward their development assistance objectives. Other public awareness priorities include enhancing linkages with national programs, non-governmental organizations relevant to the Center's work, major media organizations, and selected independent journalists.

Reducing the cost and improving the utility of our information products has involved changing our publications mix. This annual report is now more closely tailored to the information needs of those who support the Center. New publications include: *CIMMYT Research Reports* (comprehensive reviews of our research); *CIMMYT Research Briefs* (nontechnical highlights of achievements); *CIMMYT Impact Fact Sheets* (summaries of regional or country-specific impacts).



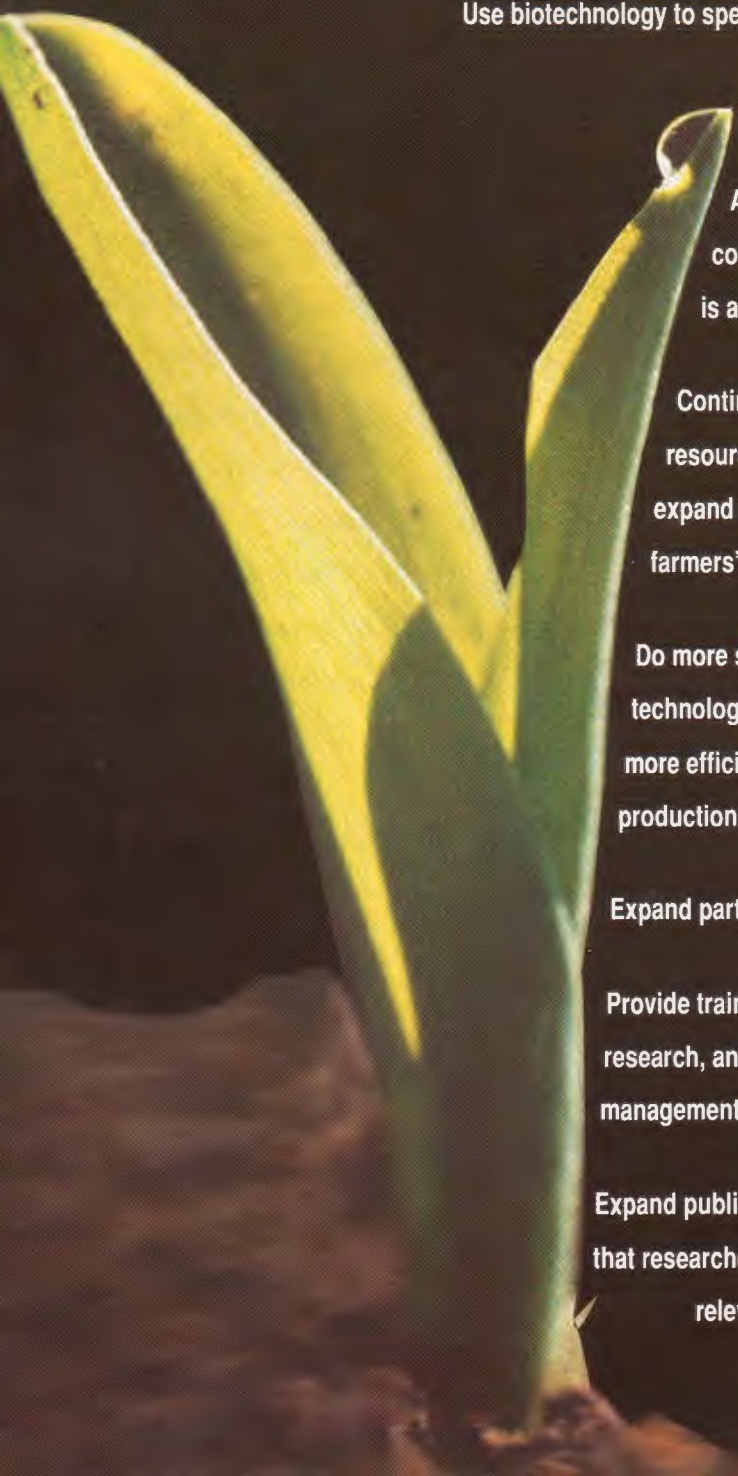
Pathways to the Future

A Synopsis of CIMMYT Strategies

In the next 20 years, maize and wheat farmers in developing countries will have to double their current harvests to keep pace with growing demand, all the while preserving natural resources required for agriculture. To help them meet this challenge, CIMMYT will...

Continue to produce high-performance maize and wheat varieties that resist insects and diseases without requiring pesticides, that use water and nutrients more efficiently, and that fit a range of farming systems.

Use biotechnology to speed breeding research in CIMMYT and in developing countries.



Increase work related to the development of hybrid maize.

Add to research on natural resource management and conservation, focusing on large ecosystems where maize or wheat is a major crop.

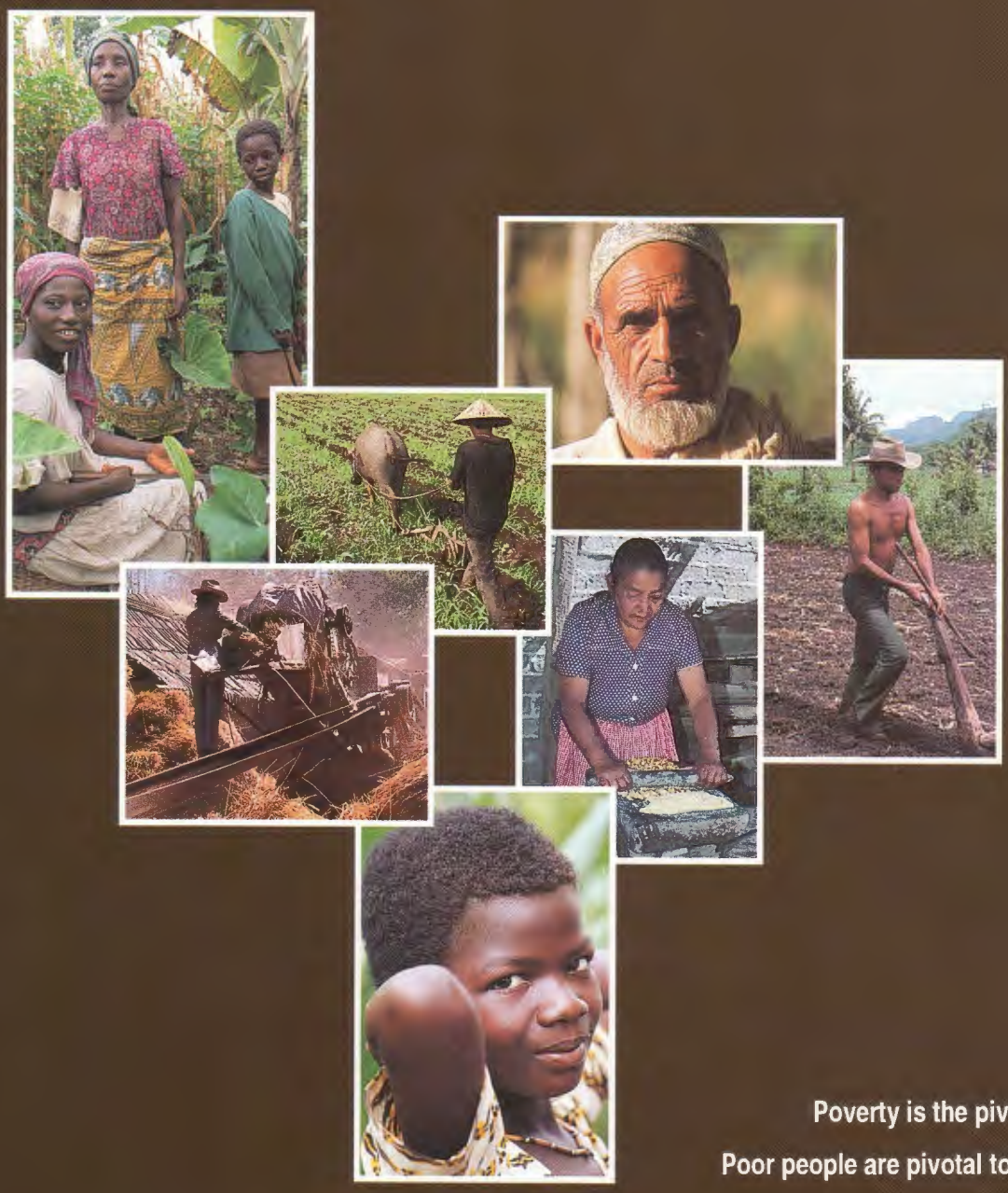
Continue efforts to rescue, store, and share maize and wheat genetic resources, including farmer-developed varieties and wild relatives, and expand work aimed at moving useful diversity from seed collections back into farmers' fields in the form of improved varieties.

Do more social science research to ensure that our environmentally friendly technologies remain "farmer friendly," to help CIMMYT and national programs work more efficiently, and to assess effects of government policy on maize and wheat production and on natural resources.

Expand partnerships with research centers of excellence worldwide.

Provide training in breeding at all levels of skill, advanced training in crop management research, and assistance to selected national programs that undertake entry-level crop management training in their regions.

Expand publishing of research findings and, through advanced technologies, ensure that researchers in CIMMYT and in developing countries have efficient access to relevant information.



Poverty is the pivotal problem;
Poor people are pivotal to the solution.
-- D.L. Winkelmann

CIMMYT

INTERNATIONAL

MAIZE AND WHEAT

IMPROVEMENT CENTER

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