

PN-AAS-735 40015

# CIMMYT

International Maize and Wheat Improvement Center

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The International Maize and Wheat Improvement Center (CIMMYT) is an internationally funded, nonprofit scientific research and training organization. Headquartered in Mexico, CIMMYT is engaged in a worldwide research program for maize, wheat and triticale, with emphasis on food production in developing countries. CIMMYT is one of 13 nonprofit international agricultural research and training centers supported by the Consultative Group for International Agricultural Research (CGIAR). The CGIAR is sponsored 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). The CGIAR consists of 45 donor countries, international and regional organizations, and private foundations.

CIMMYT receives support through the CGIAR from a number of sources, including the international aid agencies of Australia, Brazil, Canada, China, Denmark, Federal Republic of Germany, France, India, Ireland, Japan, Mexico, the Netherlands, Norway, the Philippines, Saudi Arabia, Spain, Switzerland, United Kingdom and the USA, and from the Australian Centre for International Agricultural Research, European Economic Commission, Ford Foundation, Inter-American Development Bank, International Bank for Reconstruction and Development, International Development Research Centre, OPEC Fund for International Development, Rockefeller Foundation, and the United Nations Development Programme. Responsibility for this publication rests solely with CIMMYT.

*Correct Citation:* CIMMYT 1984 Annual Report. 1985.

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Annual Report 1984

International Maize and Wheat Improvement Center

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(as of January 1, 1985)

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### Board of Trustees

During 1984, five new members joined the CIMMYT Board of Trustees. CIMMYT is indeed privileged to welcome these distinguished individuals to its Board. They are:

**Eduardo Pesquiera Olea**, Secretary of Agriculture and Water Resources, Government of Mexico, has held a variety of senior positions in the Mexican Ministry of Finance. During 1976-78, he served as an Executive Director of the World Bank, representing Mexico and other Latin American countries. Prior to assuming his new position as Secretary of Agriculture, Mr. Pesqueira was Director General of the National Bank of Rural Credit in Mexico.

**Guy Vallaëys**, Special Advisor to the Director General of CIRAD, Centre International de Recherche Agronomique en Cooperation pour le Developpement, of the Government of France, is a French agricultural research specialist and administrator well-known to many in the CG System. He began his career working in Zaire. During 1961-83, Mr. Vallaëys held various positions within IRAT (Institut de Recherches Agronomiques Tropicales et des Cultures Vivrières). Mr. Vallaëys has previously served on the governing boards of IITA and ICRISAT.

**Lucio G. Reca**, Secretary of Agriculture, Government of Argentina, is a distinguished economist, and has worked as a professor of economics and agrarian policy in various Argentinian universities. He has been a consultant to numerous international organizations and governments in Latin America. During 1976-82, Dr. Reca served on the IFPRI Board of Trustees.

**Zuang Qiao-sheng**, Deputy Director, Chinese Academy of Agricultural Sciences (CAAS), Peoples Republic of China, is a distinguished wheat scientist from the People's Republic of China. At present he holds a number of joint positions, including research professor, Head of the Plant Breeding Division and Deputy Director of the Chinese Academy of Agricultural Sciences. He also serves as coordinator of national wheat breeding programs for the National Science and Technology Council of China.

**Tomio Yoshida**, Professor of Soil Science, University of Tsukuba, Japan served during 1966-74, on the senior scientific staff of IRRI as a soil microbiologist. During 1975-78, he was Chief of the Soil Environment Section of Japan's National Institute for Environmental Sciences. Dr. Yoshida is currently serving as President of the Soil Microbiological Society of Japan.

**Search Committee for New Director General**—CIMMYT's Board of Trustees began a search in late 1984 for a new Director General. After six years of service to CIMMYT, Mr. Robert D. Havener, Director General, announced his resignation in October 1984, effective January 31, 1985, to assume the Presidency of the Winrock International Institute for Agricultural Development. The Trustees have appointed a search committee, headed by Dr. O.M. Solandt, to recruit a new Director General; Dr. Robert D. Osler, Deputy Director General, will serve as Acting Director General until this position is filled.

## Program Developments

During 1984, CIMMYT continued to make program modifications in keeping with the changing needs of our research clients in the developing world, and in accordance with the recommendations of TAC's external review of the Center in 1982.

**Maize Program**—The research agenda of the Maize Program has been expanded to include more work on hybrids, in addition to the continuing efforts to develop open-pollinated maize varieties. Information is being generated on the inbreeding depression and heterotic patterns of CIMMYT's broad-based pools and populations. Research on the development and production of non-conventional hybrids is also under way.

CIMMYT's Maize Program efforts in sub-Saharan Africa, now more closely coordinated with IITA, were expanded during the year. Plans were made to launch (in late 1985) a research program to develop germplasm for the intermediate-elevation maize production zones found throughout southern and eastern Africa. In addition, a grant from CIDA, Canada, signed in November 1984 will permit CIMMYT to post in 1985 two additional maize scientists (agronomy and training) to its regional program initiative in eastern and southern Africa. Increased emphasis will be given in this region to developing stress-tolerant germplasm.

CIMMYT began making important modifications to its maize germplasm bank facility in August 1984 which will allow the temperature in one of the cold storage rooms to be maintained at  $-15^{\circ}\text{C}$ . This modification will provide CIMMYT and the global maize research network with a long-term storage facility that will increase the lifetime (germination viability) of the seed. These modifications greatly improve CIMMYT's ability to maintain and manage this important germplasm bank collection, one of the largest in the world for maize.

New collaborative maize research projects with other institutions also were identified during 1984. In August, a U.S. Universities/CIMMYT Workshop on Maize was held at headquarters with funding provided by USAID. Six collaborative research projects were identified by Workshop participants and a committee has been established to mobilize funds for this collaborative research agenda.

**Wheat Program**—During 1984, CIMMYT and ICARDA put into effect a new division of responsibilities for wheat and barley. Briefly stated, CIMMYT will exercise a global mandate for bread and durum wheats and triticale, and ICARDA will exercise a global mandate for barley. As part of this agreement, CIMMYT has two wheat scientists posted at ICARDA's headquarters in Syria to carry out germplasm development work. Similarly, ICARDA has a barley breeder posted in Mexico at CIMMYT's headquarters to focus germplasm development work on barley production problems found in the Western Hemisphere.

In November 1984, CIMMYT launched a new research project aimed at reducing the losses in small grains caused by the barley yellow dwarf virus (BYDV), a widespread and significant disease throughout small grains areas. The overall goal of the project, funded by the Government of Italy, is to establish a network of cooperators familiar with BYDV around the world and initiate or strengthen the exchange of germplasm and information among developed and developing country research institutions.

**Economics Program**—During 1984, CIMMYT economists continued their work in the development of procedures to enhance researcher capacity to provide data and analysis for decision making in national programs. In addition, new formats and teaching materials were developed for training, and efforts in data generation and analysis for CIMMYT decision makers were increased.

Work initiated in 1983 with national program colleagues to develop research procedures to examine the real resource cost of producing maize and wheat in selected regions of their countries continued in 1984. In addition, plans were formulated to launch a new program to develop procedures which draw on on-farm research data to identify the adequacy of systems for delivering inputs, marketing products, disseminating information, and providing credit. Such information can then be used to estimate the direct losses in production associated with inadequacies in the implementation of these production support programs.



During the year, a second regional economist assigned to Asia was posted in Pakistan to serve the countries of south Asia. The emphasis on sub-Saharan Africa continued with three staff members working in eastern and southern Africa.

**Seed Health**—In September, CIMMYT expanded its activities related to seed health by establishing a seed health unit (seed pathology) that serves the various germplasm development programs at CIMMYT. This new seed health unit is responsible for conducting all standard tests for seed-borne pathogens in germplasm destined for international distribution. Added responsibilities include the development of improved methods of detection of seed-borne pathogens, tests for the efficacy of chemical seed treatments, and determination of improved seed treatment procedures. These expanded seed health activities are all conducted in close cooperation with the Mexican Plant Protection and Quarantine Organization.

**Information Services**—During 1984, CIMMYT's Information Services were reorganized. In addition to its ongoing publications and communications activities, two new initiatives were launched: an instructional materials development effort and a Scientific Information Unit (SIU).

Assistance is being provided to training officers and others engaged in developing training-related materials in: the definition of instructional objectives, structuring, visualization, testing and evaluation of teaching materials, and eventual packaging of materials for distribution and sale.

The SIU project, partially funded by IDRC, Canada, seeks to provide developing country cooperators and CIMMYT's own staff with a scientific information and documentation service related to research on the CIMMYT crops. Toward this objective, three bibliographic journals on small grains and maize are being co-published with the Commonwealth Agricultural Bureaux (CAB) and the FAO-coordinated agricultural information system (AGRIS). CIMMYT will also provide on a limited basis to its collaborators full-text copies of documents listed in the journals it distributes.

**Data Processing Services**—Considerable growth in CIMMYT's data processing capacities and services continued during 1984 with the addition of staff in systems analysis and programming, acquisition of new software, and the purchase of additional hardware. In November, CIMMYT hosted a workshop on data base management systems. In attendance were participants from five international agricultural research centers, as well as representatives from developed and developing country institutions. As a result of this workshop, participants agreed to create an informal users' group to exchange experiences and locally developed software packages. An agreement also was reached among several centers to make joint purchases of some software resulting in a considerable savings over individual purchases.

## Financial Summary

In 1984 CIMMYT was once again pleased to welcome new donors to its core programs. During the year the Governments of Brazil, Mexico and the People's Republic of China all donated funds for unrestricted support to CIMMYT's programs. In addition, the Government of Italy provided new restricted funds for research on barley yellow dwarf virus. This brings to eleven the number of new donors to CIMMYT's core budget since 1980.

1984 also saw a great deal of activity in extra-core projects. During the year the Japanese Shipbuilding Industry Foundation and the Government of Japan agreed to fund jointly the construction of CIMMYT's new training, conference and information building. Planned for completion in 1986, this building will be an important addition to the headquarters facility at El Batan. A number of new research programs also were undertaken, among them a biotechnology program funded by a consortium composed of UNDP, the Rockefeller Foundation, and the Australian Development Assistance Bureau; a maize, wheat and training program in East Africa sponsored by CIDA, and three programs in information resource management funded by IDRC. One on-going special project -- Strengthening Maize and Wheat Improvement in Pakistan funded by USAID -- was also renewed. It is

important to note, though, that these programs complement to CIMMYT's on-going research and training activities, and therefore, should not be viewed as substitutes for the core program.

Other donors sponsored young scientists for postdoctoral fellowships, and for associate and visiting scientist fellowships. Among those donors participating in this type of funding -- both on core and extra-core arrangements -- were Germany, the United Kingdom, The Netherlands, Japan, France and the Monsanto Corporation.

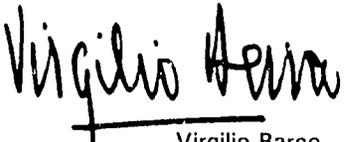
Finally, as a follow-up to TAC's external review of CIMMYT, the International Board for Plant Genetic Resources, a sister institution of the CGIAR, provided funds for the expansion of CIMMYT's maize germplasm bank. This work will be followed in 1985 by increased staffing and research in that area.

The financial situation for the year was satisfactory. Total revenues increased by 19 percent, although the bulk of this increase came from extra-core grants. Administrative fees and interest income rose also, and together these provided an important source of funds for unrestricted programs. Administrative fees help to offset operating overheads and ensure that all donors pay a fair share towards the operation and administration of CIMMYT. Interest income (where permitted by donors) is also important; its increase in recent years is at least partly due to efforts by donors to make payments as early in

the year as possible. Interest earned on short-term investments currently provides enough funds to support three international scientific staff members.

On the expenditure side in 1984, over 60 percent of all funds were devoted to research, 14 percent to training and conferences, 3 percent went to information services, and 12 percent to general administration and plant operations. Capital acquisitions also accounted for 3 percent of total expenditures and included a new greenhouse, improvements to experiment stations and laboratories, and a mini-computer for scientific and administrative use.

Inflation and exchange rates continued to cause considerable financial uncertainty. In Mexico, while the peso devalued, inflation reached 60 percent by official estimates. The net effect was a dollar-denominated inflation rate in Mexico of close to 25 percent. At the same time the US dollar remained strong against other currencies thus causing a decline in dollar-denominated grant income. Together these forces created an air of uncertainty in financial and program planning.

  
Virgilio Barco  
Chairman, Board of Trustees

  
Robert D. Havener  
Director General



CIMMYT has expanded its research and training efforts directed toward the solution of African maize production problems. Additional staff have been posted to African regions and more training fellowships are being offered.

### Introduction

CIMMYT's primary research thrust is to assist crop scientists from developing countries to produce improved maize, wheat, and triticale varieties that are capable of high and dependable yields on farmers' fields. Priority is given to developing germplasm with improved disease and insect resistance, tolerance to drought and other environmental stresses and, in the case of triticale, improved grain quality.

In addition to its crop research programs, CIMMYT is heavily engaged in training-related activities. Most of CIMMYT formal training courses are aimed at strengthening the scientific skills of relatively recent agricultural graduates who hold middle-level positions in their home country institutes. However, a wide range of other training opportunities also is offered.

To better support and complement the research and training efforts of hundreds of collaborating national programs, CIMMYT has posted 37 senior scientific staff to regional and national program assignments in Africa, Asia and Latin America.

Reported here are highlights of CIMMYT's 1984 activities in research, training and communications, and consultation. Additional detail about the Center's research program of work are found in the *1984 CIMMYT Research Highlights* and in the more than 120 technical reports and information bulletins that have been published by the Center over the last five years.

CIMMYT's organizational structure consists of three research programs—Maize, Wheat and Economics—which are responsible for research and training activities in Mexico and for their respective regional and national staff assigned to Africa, Asia, and Latin America. These research programs are supported by three research support units—Experiment Stations, Laboratories, and Data Processing—as well as by staff involved in General Administration and Information Services.

The experiment station staff are responsible for the land and input management requirements of CIMMYT's breeding programs at five principal research stations in Mexico. Four of these stations—El Batán, Poza Rica, Tlaltizapan and Toluca—are owned by CIMMYT. The fifth station, CIANO, located in northwest Mexico at Ciudad Obregon, Sonora, is owned and operated by INIA, Mexico's national agricultural research institute.

CIMMYT's laboratories include facilities for milling and baking evaluations, protein quality evaluations, soil plant tissue analyses, cytology and pathology studies, and insect mass rearing.

The Center's new data processing facility represents a major capital investment, and provides a modern data processing and computer center to serve CIMMYT's research and administrative requirements.

## Maize Research

The CIMMYT Maize Program is directed toward the development and maintenance of broad-based gene pools and populations that offer higher yield potential and greater environmental stability for developing country production conditions. Given the circumstances of the majority of maize farmers in the tropics and subtropics, the development of disease- and insect-resistant varieties is a major research objective. Because of weaknesses in the seed production and distribution systems in many collaborating countries, the development of open-pollinated varieties is emphasized. In addition, because of a growing interest in hybrids, CIMMYT increased its research activities in 1984 in this area. Information is being generated about the inbreeding depression and heterotic patterns of CIMMYT's broad-based pools and populations. Research and training regarding the development and production of non-conventional hybrids also is under way.

**Germplasm Development**—Many sources of genetic diversity have been used to form the 33 tropical, subtropical and temperate zone gene pools currently being improved and maintained in the maize improvement program. These gene pools are genetic reservoirs formed through the mixing of different germplasm with similar adaptation, maturity, grain color and texture. Several new gene pools have been constituted recently to better serve the germplasm requirements for highland areas and for areas requiring varieties with early maturity characteristics.

A major genetic resource base for the development of CIMMYT's gene pools is the Center's maize germplasm bank—one of the world's largest—with over 12,000 accessions from 46 countries. The bank preserves a wealth of potentially useful germplasm for crop improvement researchers and is operated as a service unit for resident breeders as well as national scientific collaborators. In 1984, CIMMYT supplied seed from 1068 bank accessions to research collaborators in 13 countries.

**Population Improvement**—CIMMYT is also currently handling 33 advanced populations—23 normal maize and 10 quality protein maize populations carrying the opaque-2 gene—which are suited to a range of climatic conditions (tropical, subtropical, temperate), maturity periods (early, intermediate, late), grain color (yellow, white), and kernel type (flint, dent). These advanced populations are more refined and uniform than CIMMYT's gene pools and have undergone more intensive improvement for a range of agronomic characters.

**Yield Potential**—CIMMYT has made a major research effort to increase the grain yield efficiency of tropical maize. By recurrent selection for shorter plant types, CIMMYT has achieved major reductions in the average height of many of its populations without the use of dwarfing genes. To date, CIMMYT's most outstanding populations are its tropical lowland white and yellow grain materials with intermediate to late maturity. Not only has the incidence of lodging been reduced in these materials, but the plants are more responsive to improved management and have higher yield potential through a more grain-efficient harvest index.

**Yield Dependability**—The experimental varieties developed through the international testing program continue to show many biological improvements for yield dependability. CIMMYT's germplasm improvement methodology—using a multiple-trait selection index in combination with the multilocation international testing system—is producing broadly adapted materials with polygenic resistance and/or tolerance to a host of production



The development of maize materials with enhanced tolerance to drought stress is an important research objective. Such materials can help to increase the yield dependability of this vital staple. Pictured here is a scientist using infrared equipment to measure canopy temperatures in a research plot subjected to drought stress.

problems. CIMMYT has given considerable emphasis to the development of reliable resistance in its germplasm to the major disease problems found in the developing world. Selection is exercised continuously in both pools and populations for resistance to ear and stalk rots and for leaf blights and rusts.

For those important maize diseases not present in Mexico at significant levels, CIMMYT has entered into a number of special disease-related research projects with other research institutions located in major disease-affected areas. Regional program staff have assumed the research leadership for developing germplasm with resistance to these diseases (these activities will be described later in this report). International testing program trial results show that the level of resistance of the CIMMYT germplasm to foliar diseases has improved considerably in recent years.

CIMMYT's insect-rearing laboratory produced enough insect larvae in 1984 to artificially infest and screen most

maize pools and populations for insect reaction to prevalent and important insects found in Mexico. Techniques have been perfected to raise millions of larvae to infest thousands of maize progenies. Progress has been slow in improving insect resistance in CIMMYT's pools and populations. Most evident is the resistance developed to fall armyworm and to certain classes of borers.

The materials coming out of the international testing program are showing—in addition to their higher yield potential and superior agronomic characteristics—an improved tolerance to stress situations, such as moisture stress. In addition, special research studies are continuing to evaluate alternative selection criteria that could be used to develop drought-resistant materials more quickly.

**Hybrid Development**—In any hybrid program the availability of source germplasm is very important. In this respect CIMMYT has a rich array of germplasm available for this work. This advantage is especially evident in

quality protein maize, where CIMMYT possesses a greater wealth of germplasm than anywhere else in the world.

To determine the best use of its germplasm for hybrid development, CIMMYT scientists are conducting studies on the combining ability and the heterotic patterns of its maize pools and populations. During 1984, eight diallels were developed (six involving normal-protein materials and two involving quality protein maize materials). These diallel trials will be widely distributed for international testing in 1985.

Research on the development of non-conventional hybrids also continued during the year. Using information from the International Maize Testing Program, inter-varietal hybrids have been developed using two high-performing Eto varieties in combination with several experimental varieties developed from four of CIMMYT's high-yielding tropical lowland populations. These varietal hybrid combinations will be tested during 1985.

Work was also initiated in inbred-line development during 1984. A number of vigorous S<sub>1</sub> lines were selected from CIMMYT's normal and quality protein maize pools and populations. Approximately 1,000 superior S<sub>1</sub>'s were grown during the year and the most promising of these have been advanced to S<sub>2</sub>. These will be grown in 1985 and the most promising will be advanced to S<sub>3</sub> and then internationally evaluated for general combining ability.



Maize breeders at CIMMYT draw upon the vast reserves of genetic variability in the Center's germplasm bank. Every year a portion of the bank is regenerated, and the best of this germplasm, after thorough evaluation, is introduced into the breeding program.

**Nutritional Quality**—CIMMYT has made a major program effort to improve the nutritional quality in maize—without sacrificing yield—through the use of the opaque-2 gene in combination with other genetic modifiers. As a result of this research effort, the problems originally associated with opaque-2 maize, such as reduced yield, vulnerability to ear rots and stored-grain pests, and the dull chalky appearance have been largely overcome. Various normal-looking white and yellow grain experimental varieties have been developed that are equal to or superior in yield potential to many normal maize varieties under cultivation in the developing world.

**Wide Cross Research**—Crosses between maize and alien genera are being pursued to determine the feasibility of using potentially useful genes from these genera for maize improvement. The aim is to make maize a more environmentally stable crop with better disease and insect resistance and greater tolerances of moisture stresses, such as drought and waterlogging. The greatest success to date has been with the maize x *Tripsacum* crosses and this hybrid combination is now receiving the major research attention.

More than a dozen *Tripsacum* parents have been isolated as F<sub>1</sub> combinations with different CIMMYT maize materials. A collection of "tripsacoid" maize materials developed by scientists at the University of Illinois (USA) is being crossed to various CIMMYT populations in order to evaluate useful genes for increased resistance to several diseases and insects of maize and to convert this material to tropical and subtropical adaptation. Collaboration also continued with University of Illinois scientists on a new "Transforming DNA" technique which hopefully can increase the speed of obtaining maize introgressed with genes from other crop species.

**International Testing**—International testing plays a major role in CIMMYT's maize improvement system. The center's maize populations are tested at several stages of advancement after the judgment is made that the material offers superior germplasm for some part of the developing world. National collaborators are key partners in the development of these materials. Their on-site selections provide the basis for developing the experimental varieties entered into the international variety testing program.

More than 800 experimental varieties have been developed since CIMMYT began the current scheme of population improvement through international testing less than a decade ago. Twenty-nine national programs, drawing on germplasm developed through the international testing program, have released more than 120 varieties and hybrids during the last five years. Dozens more new varieties are now in the final stages of national varietal trials and commercial release.



In 1984, CIMMYT shipped 507 individual maize trials to collaborators in 65 countries (see Appendix I). Three types of trials were included in the 1984 international testing program:

**International Progeny Testing Trials (IPTTs)**—Consisting of 250 progenies selected from each advanced population and tested at six sites worldwide to identify the best-performing families to form experimental varieties.

**International Experimental Variety Trials (EVTs)**—Consisting of the experimental varieties developed through the IPTT system from each population.

**International Elite Experimental Variety Trials (ELVTs)**—Consisting of an elite selection of the best-performing experimental varieties identified through the EVT's of previous years.

In 1984, fifteen advanced populations were tested in IPTTs during the year. Seven different EVT's were also distributed. The most frequently requested EVT's during 1984 were EVT's 12 and 13, sent to 61 and 53 locations, respectively; these trials include CIMMYT's best full-season white and yellow grain tropical lowland varieties. In addition, two ELVT's, 18 A and 18 B, composed of CIMMYT's best-performing elite experimental varieties, were distributed in 1984 to 70 locations throughout the developing world.

To qualify for shipment, maize seed from CIMMYT must come from healthy plants which are free of seed-borne diseases. In addition, all seed shipped from CIMMYT is treated with a fungicide and a systemic insecticide.



Each year CIMMYT has a number of postdoctoral fellows in residence in Mexico. All are given opportunities to develop their field and laboratory skills needed to execute effective research programs. Pictured here is a postdoctoral fellow who plays a key role in CIMMYT's Karnal bunt research.

## Wheat Research

The CIMMYT Wheat Program conducts research on bread wheat, durum wheat, and triticale. Until July 1984, CIMMYT was also engaged in barley improvement; this effort has now been merged into ICARDA's barley improvement program. Since CIMMYT's inception, over 300 high-yielding bread wheat varieties, 50 durum wheat varieties, 56 triticale varieties and 8 barley varieties, carrying CIMMYT germplasm in their parentage have been released by national programs. This record of contribution to varietal improvement in the developing world is unparalleled in the field of international agricultural research.

**International Nursery Program**—In 1984, more than a 500,000 packets of experimental wheat, triticale and barley seed were assembled into 44 screening and yield nurseries, crossing blocks, and segregating populations for distribution and testing at hundreds of locations worldwide. In 1984, collaborating scientists in 97 countries requested 2,052 trials of wheat, triticale and barley from these different germplasm nursery categories (see Appendix 1). New nursery categories have been created for germplasm with early-maturing characteristics, suitability for dryland conditions, special disease and soil stress problems, and for heat and cold tolerant materials.

Given the greater need for more site-specific screening for many of these problems, CIMMYT is increasingly relying on regional staff to help guide and implement germplasm development. More specific collaborative research arrangements for germplasm screening also are being established with selected national programs strategically located to address a particular problem.

International testing has played a key research function in CIMMYT's efforts to develop broadly adapted cultivars and to speed their distribution to national program collaborators. This international research network has also facilitated the introduction of significant

new genetic variability—essential to progress in plant breeding—into national crop improvement programs and has served as a unifying thread to bring together the work of thousands of scientists worldwide.

**Bread Wheat**—The bread wheat program is the largest of CIMMYT's small grains improvement efforts. More than 1,000 advanced lines were evaluated in yield trials in Sonora in 1984. Since 1980, over 50 high-yielding bread wheat varieties based on CIMMYT germplasm have been released in 22 countries. A broad genetic base is maintained in the CIMMYT materials for such characters as yield, wide adaptation, seed quality and disease resistance.

The best yielding bread wheat lines today are progeny of spring x winter crosses, which have added 5 to 10 percent to maximum yield potential and greater yield dependability when compared to CIMMYT's best pure spring habit semidwarf wheat varieties. The wide adaptation of these spring x winter lines is also evident from the international trials. One cross, Veery, has produced a number of high yielding lines that have been the top yielders during the last four years of international testing. Added drought tolerance and improved disease resistance are also increasingly evident in some spring x winter materials.

A continuing strong emphasis in bread wheat research is placed on enhanced disease resistance, particularly to the major rusts—leaf, stem and stripe—which still constitute the major disease threat to dependable yields in much of the developing world. Achieving more stable leaf rust resistance has proven the most elusive. Some of CIMMYT's bread wheat cultivars have demonstrated a "slow rusting" characteristic, i.e., they become infected with leaf rust, but disease

development proceeds at such a slow rate that little reduction in yield occurs. Materials with this low receptivity for infection and long latent period for disease development are being used extensively in the current crossing program.

Other disease problems also are being addressed. In particular, considerable research attention is given to developing materials with higher levels of resistance to the fungal diseases of *Septoria* spp. More recently, the development of materials with resistance to *Fusarium* spp., (an important disease problem in central China and other areas with warm, humid climates) and *Helminthosporium* spp. (also a disease problem in hotter production areas), have increased in priority. CIMMYT is collaborating closely with Chinese scientists to develop materials with greater resistance to *Fusarium* spp. and with Bangladeshi and Brazilian scientists to develop materials with greater resistance to *Helminthosporium* spp.

A number of high-yielding bread wheat lines with tolerance to the higher levels of free aluminum often found in acid soil areas and with improved resistance to the many diseases found in these environments are being rapidly developed through a cooperative shuttle breeding program with national scientists from Brazil. With adequate disease resistance, these varieties will yield up to twice as much as the currently available commercial varieties grown in Brazil's wheat production areas with acid soils that are high in soluble aluminum.

CIMMYT continued in 1984 its research on the problems associated with wheat production in the warmer, more tropical production environments. Our research focuses on developing greater resistance to certain diseases, such as helminthosporium and fusarium, and on developing greater tolerance to heat stresses which can affect the tillering and grain-filling abilities of wheat grown in these hotter environments.

**Durum Wheat**—Durum wheat is used principally for making pasta products and certain types of unleavened bread. Worldwide, this wheat species is grown on about 30 million hectares, with roughly 11 million hectares in production in the developing world (principally the rainfed production areas in the Mediterranean basin countries of North Africa and the Middle East, Argentina and Chile).

CIMMYT's best durum materials today are equal to, or higher-yielding than, the best bread wheat materials. Yields of up to 10 t/ha have been recorded at certain international testing locations and approximately 50 high-yielding durum varieties, that are based on CIMMYT germplasm, have been released in 15 countries.

CIMMYT's current durum crossing program places a heavy emphasis on improving disease resistance. The development of durum lines with high levels of yellow rust resistance has been quite successful. However, better resistance to stem rust, septoria and fusarium is needed, since high levels of susceptibility to these diseases are still recorded in many production areas. Good source of genetic resistance to these diseases exist within CIMMYT's durum wheat crossing blocks and are being fully exploited to pyramid genes for better and more stable resistance.

More winter x spring crosses are being made each year to capitalize on genes found in winter habit durum wheats for enhanced tolerance to cold and drought stress conditions and to increase the levels of resistance to certain diseases. Efforts to modify the head architecture in the durum plant to reduce the



In addition to their research responsibilities, each of CIMMYT's senior scientific staff participates in training-related activities. Pictured here is the head of the bread wheat germplasm engaged in a discussion on germplasm development priorities with a group of in-service trainees.

incidence of head-rotting diseases that affect durum in many areas have been quite successful.

Considerable headway has also been made in developing sawfly-resistant durum types with solid stems for areas in North Africa where sawflies can cause serious damage in normal semidwarf materials. Continuing efforts are also being made to develop earlier-maturing varieties with good yield potential and disease resistance. Such materials would be particularly advantageous in areas characterized by drought stress problems and/or with a short growing season.

There is a growing export potential for durum wheats with large size grain, high test weights and acceptable pigment and protein content. To help collaborating developing countries that have the potential to export durum

wheat, CIMMYT's cereal quality laboratory staff have worked closely with the breeding staff to develop durum wheats that maintain high industrial quality characteristics during macaroni processing. Numerous lines with high yield potential and satisfactory quality characteristics have been developed.

**Triticale**—Triticale resulted from the successful hybridization of wheat and rye. Triticale attains considerably higher yields than wheat in acidic soils, high elevations, and semiarid conditions. At present, triticale is an important crop in only a few countries, but is in the process of becoming more widely accepted. Approximately 56 high-yielding triticale varieties based on CIMMYT materials have been released (53 since 1978) by national programs in 18 countries. Approximately 700,000 hectares are now in

commercial production. While most of this area is located in developed countries, the surge in varietal releases in developing countries indicates a rapidly growing interest in triticale, both as a food and forage-feed crop.

The primary objective of CIMMYT's triticale program is to produce germplasm with high-yielding capacity and wide adaptability. These broad objectives are accomplished by making numerous crosses among the various forms of triticale and wheat. Intensive selection pressure is applied for yield, test weight, and disease resistance. In addition, traits such as tolerance to sprouting, drought, and acid soils, improved industrial quality and earlier maturity are pursued.

Problems of lodging, late maturity and inferior grain quality have been overcome to a considerable extent. Many medium-tall semidwarf triticale types with greatly improved straw strength have been developed. In addition, a new range of earlier-maturing triticales were again sent out for international testing in 1984. A few of these lines ripen within five days of CIMMYT's earliest-maturing wheat materials.

The major drawbacks in CIMMYT's triticale materials are still in grain type and the tendency for the grain to sprout before harvest. Although it has been relatively easy to find triticales with high grain test weights when grown under favorable production conditions, these test weights drop sharply as production environments become less favorable. Considerable progress has been achieved in recent years to overcome this problem. Recent research data on test weights show a number of



CIMMYT's durum wheats are extremely high-yielding and have excellent industrial quality, high test weights and acceptable pigment and protein content. Current research objectives emphasize the development of greater disease resistance and enhanced yield dependability under a variety of environmental stress conditions.

high-yielding triticale lines with more acceptable and stable test weights within 10 percent of commercial bread wheat varieties. Improvements in preharvest grain sprouting have also been made, although higher levels of resistance are still required.

**Barley**—CIMMYT began its improvement work on barley as a human food more than a decade ago. Today this improvement program is conducted under the leadership of ICARDA, with a breeder stationed at CIMMYT for germplasm development work in the Western Hemisphere. A shuttle breeding program between Mexico and the Andean zone (where very heavy natural disease levels exist) has been initiated to speed up the development of disease resistance. Effective artificial disease epidemics are also created in Mexico to impart heavier disease pressure on these materials in

order to identify resistant types. F<sub>6</sub> lines with excellent agronomic type and with a combination of scald and leaf rust resistance were entered in yield trials during the 1983-84 season.

Several hundred lines have been identified with resistance to the major barley diseases and have been assembled into a special disease-resistance crossing block, which was distributed in 1984 to collaborators for testing in 49 locations in 28 countries. More intensive use has been made of winter barley germplasm in spring x winter crosses to develop high-yielding barleys for production areas (such as in Mediterranean countries) requiring late-maturing varieties. Conversely, in other barley growing regions with low moisture or short-season environments, earlier-maturing barleys are needed. Superior lines for both maturity extremes are being rapidly developed.

**Germplasm Bank Unit**—In total, CIMMYT had in 1984 approximately 40,000 entries in its small grains germplasm bank. This collection includes 22,722 bread wheat, durum wheat, triticale and barley germplasm entries from the CIMMYT breeding programs as well as 18,193 new germplasm entries from other germplasm banks around the world. More than 10,000 seed collections were rejuvenated during the 1983-84 season at Ciudad Obregon and El Batan and carefully selected and conditioned new seed replaced the old. Morphological and agronomic characters were recorded for each of these collections. During the year, seed of 3,211 collections was supplied to collaborators from national programs. Initial steps also were taken to computerize the information being generated on the germplasm bank collections.

**Special Germplasm Development**—To capitalize on potentially valuable germplasm that cannot be readily utilized in the conventional breeding programs, CIMMYT has a special research unit that attempts to transfer useful genes into lines with good agronomic characteristics. One project involves the development of separate source populations (gene pools) for resistance to *helminthosporium* and *fusarium* in bread wheat, durum wheat and triticale. Another expanded research effort is aimed at developing higher yielding rye types and bread wheats with particularly high grain quality for use as parental stock in the development of new triticales with higher yield potential and better grain quality.



CIMMYT's triticale program places emphasis on developing germplasm for areas with acid soils, cool highland environments, and semi-arid conditions. High-yielding materials with excellent performance potential are being developed for many of these more difficult production environments.



CIMMYT is in the process of developing computer-based information systems for its wheat research program. As part of this effort, electronic notebooks are now being used for direct data entry in the field.

Work also continued in 1984 on the yield components of bread and durum wheats and triticale. Lines with up to nine grains per spikelet (3-5 are the normal number in bread wheat) and twice the number of spikelets per head have been obtained. Grain-filling is the principal problem in these crosses. In addition, larger heads have usually been accompanied by reduced tillering capacity. Some progress has been achieved in improving the trade-off between larger heads and reduced tillering ability, although problems of grain plumpness still exist in these lines.

Four special nurseries containing germplasm developed in this unit were sent for evaluation to collaborators in 65 countries during 1984. Two of these nurseries included the best lines developed in the yield component research on bread wheat and durum wheat. The other two nurseries included source materials developed in previous years with high levels of resistance to leaf rust and with tolerance to high levels of soluble aluminum in the soil solution.

**Wide Cross Research**—Still another research area receiving greater attention at CIMMYT is the transfer to wheat of useful genes from related genera. Exciting progress is being made in this research program. The focus of the work is to obtain better resistance to certain diseases, such as those caused by *Helminthosporium sativum*, *Fusarium graminearum*, and *Neovossia indica*, as well as stress tolerance to high concentrations of salt and aluminium and to copper deficiencies. Of the half dozen genera hybridized with wheat, the major species being utilized in the program belong to *Agropyron*, *Elymus* and *Aegilops* species. Using this germplasm, 156 F<sub>1</sub> hybrid combinations have been achieved and advanced backcross progenies are being developed from many of these. The more advanced backcross progenies from these hybrid combinations are now being evaluated in field trials in Mexico to determine the levels of increased resistance and/or tolerance that have been conferred.

Some initial results show resistance to *H. sativum* and efforts are under way to transfer this alien resistance to a stable wheat background. In 1984, 7,514 lines derived from crosses of bread wheat, with either *Aegilops* or *Elymus* were tested at CIMMYT's Poza Rica station. Selections for each combination demonstrated satisfactory resistance to the pathogen.

During 1984, hybrid combinations were also field tested at CIMMYT's Toluca station following inoculation for resistance to fusarium head scab. Of the 367 resistant selections for *F. graminearum*, 132 were from *Elymus* derivatives and 235 from *Aegilops* derivatives.

Research also continued to transfer into wheat, via wide crosses, new sources of resistance to Karnal bunt and leaf and stem rust. Work to develop wheats with increased tolerance to high concentrations of salt, aluminum and copper in the soil is also progressing at a satisfactory pace.

**Agronomy Research**—Much of CIMMYT's agronomy research is carried out under the auspices of regional and national program projects. Some agronomy (and physiology) research, however, is also carried out in Mexico by the headquarters-based agronomy program staff. In particular, headquarters agronomists are becoming increasingly active participants with CIMMYT's breeders in the development of crop improvement methodologies for environmental stress situations such as drought, heat and cold. Other types of nursery management issues related to fertilization, weed control and irrigation scheduling are investigated also by the agronomy program. Finally, some production-oriented on-farm research trials relevant to wheat and barley production systems in the Yaqui valley and the high plateau areas of central Mexico were carried out during the year as part of the INIA-CIMMYT cooperative national wheat improvement program.

## Economics Program

The CIMMYT Economics Program has made a major contribution to the development of a conceptual framework for assessing the production circumstances of representative farmers in the Third World. Cost-effective research procedures have been developed to help understand the most important production problems and resource circumstances faced by the majority of farmers (in target research areas). This information is then used to orient subsequent crop research aimed at developing improved technologies. The on-farm research procedures developed by the Economics Program staff, in conjunction with CIMMYT and national program biological scientists, are now being used in many production-oriented research programs in the developing world.

CIMMYT economists are also involved in research studies related to the production and utilization of maize and wheat in the world economy. A research project is under way to develop techniques for estimating the real resource costs for producing commodities such as maize and wheat. Data collection and trend analyses about the world maize and wheat economies also continue.

**Technology Generation**—From the outset, the Economics Program staff has sought to work with selected national programs in developing, demonstrating and institutionalizing on-farm research procedures. By 1984, more than a dozen collaborating national research institutes in Africa and Latin America were well on the way towards integrating on-farm research procedures into the process of technology generation. During the year, CIMMYT staff worked closely with scientists and research administrators to strengthen these on-farm research programs further.

CIMMYT Economics Staff are actively engaged with biological scientists in collaborative research aimed at technology generation. An important component of this research is the assessment of farmers circumstances as a prerequisite for planning subsequent experiments.

### Research Resource Allocation—

Research systems face the problem of allocating their resources among competing crops and regions. This process can be helped by measuring the likely effects of research on the use of national resources associated with production. To address such issues, CIMMYT economists have undertaken to adapt an analytical framework of comparative advantage to determine the private and social profitability of producing crops such as maize and wheat, relative to alternative crops. This type of research provides a means of linking research decisions to the environment in which researchers and farmers make decisions. The economics program, in cooperation with national program colleagues, completed three studies in 1983-84 on the comparative advantage of wheat production in two regions of Mexico, in highland Ecuador and in Thailand.

**Assessing Aspects of Policy**—A third set of research procedures are being developed that take advantage of farm-level research data to identify the

adequacy of systems for the delivery of inputs, marketing product, disseminating information, and providing credit. With this methodology, assessments can be made of the direct loss associated with inadequacies in implementation of current policies affecting production support systems. CIMMYT's goal in this work is to derive cost-effective methods for undertaking this sort of research and to synthesize these procedures in manuals appropriate for use in national programs.

**Data Collection and Analysis**—In recent years, the economics program has increased its data collection and analysis on the maize and wheat world economies. In 1981-82, CIMMYT initiated two new serial publications: World Wheat Facts and Trends and World Maize Facts and Trends. These reports assemble, on a regular basis, pertinent data related to maize and wheat production, utilization, and trade, and present this information in a readily digestible form for agricultural administrators, researchers or policy makers.



In 1984, CIMMYT published Report Two of World Maize Facts and Trends: "An Analysis of Third World Feed and Food Uses of Maize." This report reviews the dramatic changes over the last decade in the uses of maize throughout the developing world. Where incomes have risen, developing country producers are spending a higher proportion of their food budget on livestock products and less on maize as a staple food in their diet. Population, income and urban growth will dictate the rate of increase in the demand for maize as a livestock feed, and there is great potential for growth in the use of maize as a feed grain in the developing world for the remainder of this century. With increasing productivity through the use of improved technologies, most of this rising demand can be met through domestic production.

## Training Programs

Training continues to be a major dimension of CIMMYT's total institutional effort. Training activities in Mexico, within the regions, and in national program settings stress the strengthening of field and laboratory research skills needed to conduct effective crop research programs. An increasingly diversified number of training opportunities are offered.

**Maize Training**—During 1984, seventy-six research workers from 32 developing countries attended in-service training at CIMMYT (see Appendix II). Four technical training courses were offered: crop improvement, crop production, protein quality laboratory research, and experiment station management. Sixty-five percent of the in-service trainees were enrolled in the crop production course. Another 13

visiting scientists were invited to CIMMYT during the year, spending 1-3 months in Mexico. During 1984, CIMMYT cooperated in the training of seven M.Sc and one Ph.D degree students from developing countries. In addition, six postdoctoral fellows were in residence at CIMMYT in Mexico during the year.

**Wheat Training**--During 1984, forty-eight in-service wheat scientists from 21 countries participated in CIMMYT's in-service training program (see Appendix II). Four technical training courses were offered: crop improvement, crop production, cereal technology and experiment station management. Travel fellowships for 21 visiting scientists were also provided in 1984. CIMMYT also cooperated in the training of seven M.Sc and two Ph.D students from developing countries during 1984. In addition, ten postdoctoral fellows were in residence during the year.

**Economics Training**—The economics staff continued their participation in 1984 in the maize and wheat crop production in-service training courses held in Mexico. In addition, a number of in-country training courses were undertaken in collaboration with other CIMMYT crops program staff and national program staff. Activity is especially strong in southern and eastern Africa, where CIMMYT has posted a full-time training officer to support national training efforts within the region. One postdoctoral fellow also worked within the Economics Program during 1984.

**In-Country Training**  
During 1984, CIMMYT staff participated in dozens of in-country training courses in Africa, Asia and Latin America. These courses took a variety of forms from short-courses on specific subjects, to germplasm evaluation tours, to on-farm research methodologies.



CIMMYT's in-service wheat production training course emphasizes on-farm research procedures. During their 7-month stay in Mexico, trainees conduct farm-level surveys, diagnose production problems, design on-farm experiments and analyze the resulting data. Pictured here are CIMMYT Wheat Staff reviewing the on-farm experiments of training course participants.

## Regional Programs

During 1984, twenty-nine senior staff members were assigned to regional maize, wheat and economics programs (through core and extra-core grants).

Region	Maize	Wheat	Economics
Central America, Mexico & Caribbean	4 <sup>a/</sup>	—	1
Andean countries	3	2	—
South American Southern Cone	—	2	—
North & West Africa	2	1	—
Middle East	1	1	—
Eastern and Southern Africa	1	1	3 <sup>a/</sup>
Asia	2	2 <sup>b/</sup>	2
Total	13	10	6

a/ Includes extra-core funded position(s)

b/ Includes one position for tropical wheat research

Regional staff have important research and training responsibilities in addition to their liaison activities between CIMMYT headquarters and developing country national programs. The shifting of certain research responsibilities from headquarters to the staff posted in regional programs is an important element in CIMMYT's strategy to expand its research activities on important germplasm development and crop management problems not easily addressed in Mexico.

Participation in in-country training courses, especially in the area of production-oriented research (often conducted on-farm), is also an important program activity. In addition, regional staff have important networking responsibilities and help to organize regional conferences and workshops.

In the Maize Program, the responsibility for a number of disease-related research projects, originally organized between CIMMYT headquarters staff and

national collaborators in strategically located countries, has been shifted to the Center's regional program staff located in the major disease-affected areas. International collaboration is under way on three major diseases of maize: downy mildew, a major problem in Asia, streak virus, a serious disease problem in Africa, and corn stunt virus, mainly a problem in Latin America.

The work on downy mildew is centered in Thailand with cooperation from research institutes in the region. Several of CIMMYT's advanced populations that are adapted to Asian maize production conditions have been undergoing improvement for downy mildew resistance and IPTTs were sent for testing at six locations worldwide. International trials data on these materials report much higher levels of

resistance to this pathogen than existed previously in CIMMYT materials. Six Asian countries have now released varieties with downy mildew resistance.

Prior to the establishment of a collaborative research project with IITA and several West African national programs, CIMMYT's work on streak virus resistance lacked a suitable facility to rear the vector needed to ensure adequate selection pressure. Sources of resistance from IITA's germplasm are now being incorporated into one of CIMMYT's high-yielding tropical lowland populations. High-yielding experimental varieties with enhanced streak virus resistance have been developed and were distributed to 26 African countries in 1984. Streak-resistant varieties emanating from this work have been released in four West African countries.



CIMMYT collaborative research project with the International Institute for Tropical Agriculture (IITA) and several West African national programs has led to the development of high-yielding varieties and hybrids with resistance to streak virus, a major yield-limiting disease in many parts of tropical Africa.

The work on corn stunt resistance is being handled by the research staff in Mexico in collaboration with the Central American and Caribbean regional program and national research collaborators. Good progress has been made in developing high-yielding varieties with resistance to corn stunt virus, and a number are now in production in Central America.

In the Wheat Program, a number of regional disease screening and surveillance nurseries, as well as regional yield trials, were prepared and distributed by regional program staff members. Two regional screening nurseries (bread wheat and barley) were prepared and distributed to 11 countries in 1984 by the Andean regional program staff, in cooperation with Ecuador's national wheat research program. Regional screening nurseries were also prepared by the regional wheat staff assigned to the Southern

Cone and Eastern and Southern Africa. In addition, the staff assigned to East Africa assisted the Kenyan national government in the operation of an extensive off-season nursery program as a service to other African and Asian national research programs.

In the Economics Program, regional economists were actively engaged in collaborative research projects to demonstrate and train in aspects of on-farm research aimed at technology generation. The Asian regional economics program was strengthened in 1984 with the addition of one staff member posted to Pakistan to cover South Asia. The two economics staff members working in the Eastern and Southern African regional economics program (through extra-core financing from USAID) continued their cooperative research and training programs with national research institutes engaged in on-farm research.

## Information Services

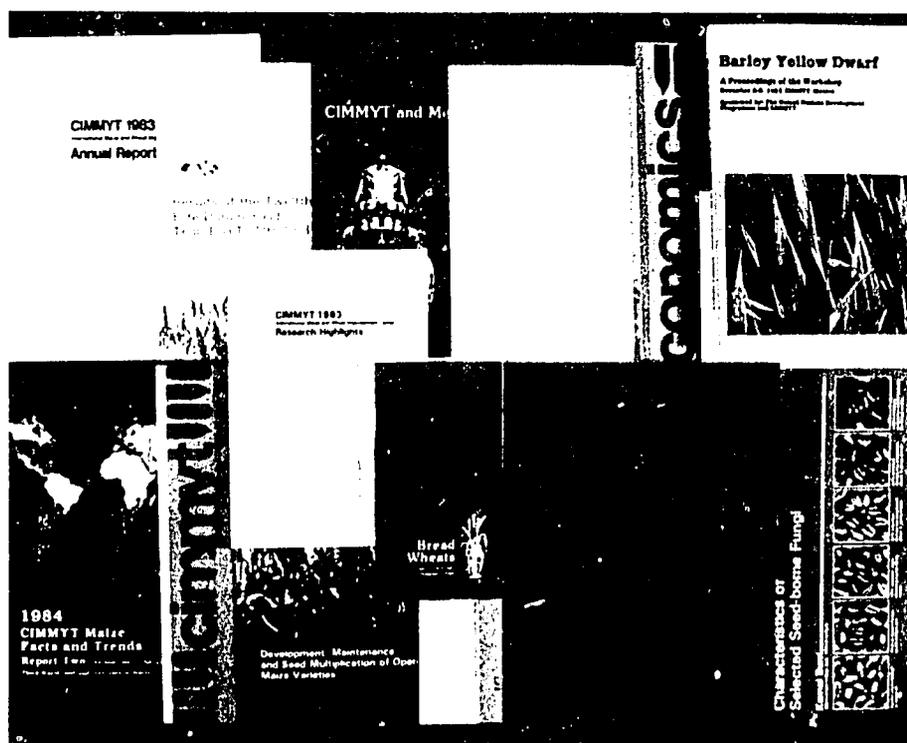
During 1984, two new activities were added to CIMMYT's program of Information Services. A new Scientific Information Unit (SIU) was created in September 1984, with partial funding from the International Development Research Centre (IDRC). The SIU has online computer access to major scientific information databases, is responsible for co-publication of several bibliographic abstract journal, and is offering bibliographic and document delivery services to national collaborators and CIMMYT staff. In addition, the SIU is helping to develop a number of internal databases needed by CIMMYT to manage its research and training programs more effectively.

In 1984, the Information Services group also began a program to develop instructional materials describing CIMMYT's research concepts and procedures, in collaboration with program training officers and other scientific staff. During 1984, some training materials were developed for testing during the 1985 in-service training cycle. Once tested and refined, these materials will be packaged and made available to collaborating research institutions in the developing world.

In 1984, CIMMYT published 40 new titles (see Appendix III) and distributed these according to interest areas to a mailing list of 5,700 names. In addition, six issues of the *Wheat, Barley, and Triticale Abstracts*, co-published with the Commonwealth Agricultural Bureaux (CAB), were sent to CIMMYT's closest national research collaborators and technical wheat libraries in the developing world.

More than 100 other scientific papers were prepared for publication in scientific journals or for presentation at international and national meetings; a list of these is included in Appendix III.

During 1985, CIMMYT published 40 new titles and distributed these according to interest to a mailing of 5,700 researchers and libraries in 140 countries.

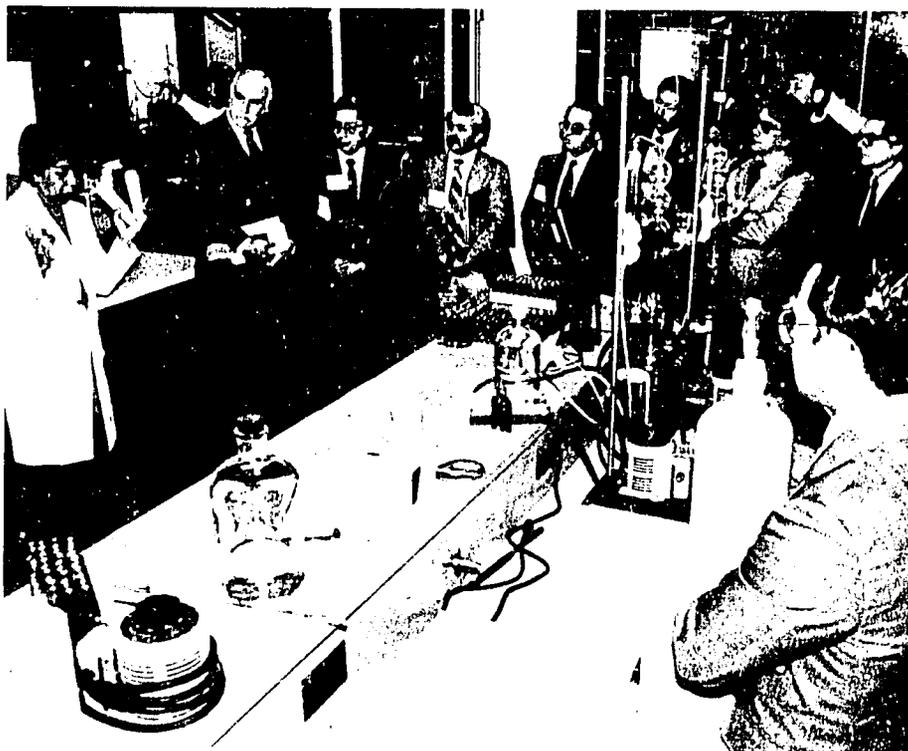


## Conferences

During 1984, CIMMYT cosponsored a number of conferences both at headquarters and on a regional or national basis. At headquarters, three major scientific conferences were held during the year. The first was the U.S. Universities-CIMMYT Maize Conference held in June. At this meeting, U.S. university maize scientists participated with CIMMYT scientists and national program colleagues in the development of an agenda for nine future collaborative research projects. The second was the Symposium on Wheat for More Tropical Environments, held in September 1984, with 60 wheat scientists from around the world in attendance. The third was the Seminar on Strategies to Strengthen Agricultural Research in Latin America and the Caribbean, held in September 1984 under the co-sponsorship of the Inter-American Development Bank (IDB) and CIMMYT. In attendance were the research leaders of virtually every national agricultural research institution in this region.

## Consultation

The active consultation schedules of the CIMMYT staff (over 3,300 mandays in 57 developing countries in 1984) is a key dimension in keeping the Center's research and training programs well-targeted to the needs of national programs in the developing world. During 1984, scores of field trips were carried out by CIMMYT's regional and headquarters staff to review materials from the international nurseries as well as national breeding programs. This heavy travel agenda helps to provide follow-up support to former CIMMYT trainees as well as to identify new prospective training program candidates. Finally, CIMMYT's senior staff were called upon frequently during the year by national research leaders to advise on the organization of national maize and wheat research programs as well as on significant production-related problems in which CIMMYT has expertise.



CIMMYT-hosted conferences and workshops provide a venue for scientists and research administrators from the developing world to discuss research problems and to exchange information on research projects. These gatherings help CIMMYT to establish its research priorities and serve to strengthen its communications with maize and wheat researchers worldwide.

# International Testing

## Appendix I Distribution of international maize trials, 1982-84

Region and country	1982 trials	1983 trials	1984 trials	Region and country	1982 trials	1983 trials	1984 trials
<b>Central America, Mexico and Caribbean</b>	<b>181</b>	<b>201</b>	<b>137</b>	Guinea	—	10	7
Bahamas	2	—	—	Guinea-Bissau	5	4	2
Barbados	9	—	—	Ivory Coast	6	5	7
Belize	6	3	—	Kenya	6	39	—
Costa Rica	9	31	—	Liberia	5	—	2
Cuba	3	2	—	Malawi	10	1	7
Dominican Republic	6	10	7	Mali	7	23	8
El Salvador	7	10	5	Mozambique	18	—	2
Guatemala	16	17	16	Nigeria	12	4	5
Haiti	—	4	—	Rep. South Africa	10	—	2
Honduras	20	20	12	Reunion	—	—	1
Jamaica	8	2	2	Senegal	10	8	13
Mexico	63	68	34	Sierra Leone	—	33	16
Nicaragua	18	6	30	Somalia	5	9	6
Panama	14	26	25	Sudan	5	—	10
St. Kitts	—	—	6	Swaziland	6	6	6
Trinidad	—	2	—	Tanzania	5	11	—
				Togo	14	12	11
				Transkei	2	—	—
<b>South America</b>	<b>88</b>	<b>114</b>	<b>77</b>	Uganda	7	5	—
Argentina	5	18	9	Zaire	6	12	4
Bolivia	15	13	2	Zambia	—	6	1
Brazil	38	39	10	Zimbabwe	9	15	9
Chile	2	1	1				
Colombia	1	8	4	<b>Asia</b>	<b>130</b>	<b>186</b>	<b>113</b>
Ecuador	2	—	1	Afghanistan	4	1	—
Paraguay	4	—	10	Bangladesh	8	8	14
Peru	12	16	22	Burma	1	9	—
Surinam	—	3	—	India	20	28	9
Uruguay	1	1	1	Indonesia	7	6	11
Venezuela	8	15	17	Korea, South	1	1	—
				Malaysia	7	7	2
<b>Mediterranean/Mideast</b>	<b>30</b>	<b>24</b>	<b>23</b>	Nepal	8	7	1
Algeria	1	—	—	Pakistan	23	17	17
Egypt	5	2	6	Philippines	13	43	12
Iraq	—	—	2	Sri Lanka	—	6	—
Libya	2	—	—	Thailand	14	45	33
Morocco	5	—	7	Vietnam	22	8	14
Quatar	—	2	—				
Saudi Arabia	3	13	—	<b>Other</b>	<b>14</b>	<b>25</b>	<b>8</b>
Syria	—	—	1	France	2	—	4
Turkey	8	—	4	Germany, Fed. Rep.	3	—	—
Yemen A.R.	6	7	3	Greece	2	2	2
				New Guinea	—	12	—
<b>Sub-Saharan Africa</b>	<b>189</b>	<b>252</b>	<b>149</b>	Spain	—	—	1
Angola	11	3	2	Tahiti	1	—	—
Benin	4	6	—	USA	6	11	1
Burkina Faso	5	12	10				
Burundi	—	12	—	<b>TOTAL TRIALS</b>	<b>632</b>	<b>802</b>	<b>507</b>
Cameroon	10	6	6	<b>TOTAL COUNTRIES</b>	<b>73</b>	<b>68</b>	<b>65</b>
Cape Verde	3	4	3				
Central African Republic	—	—	2				
Congo	4	—	—				
Gabon	—	2	2				
Gambia	—	2	2				
Ghana	4	2	3				

Appendix I (cont'd)

Distribution of international bread wheat, durum, triticale, and barley nurseries, 1984

	Bread wheat	Durum	Triti- cale	Barley		Bread wheat	Durum	Triti- cale	Barley
<b>Latin America</b>	<b>278</b>	<b>79</b>	<b>78</b>	<b>29</b>	<b>Asia</b>	<b>240</b>	<b>38</b>	<b>36</b>	<b>37</b>
Argentina	49	26	7	0	Afghanistan	8	4	2	4
Bolivia	18	11	5	3	Bangladesh	21	1	2	1
Brazil	80	7	20	7	Bhutan	4	1	1	1
Chile	26	13	7	2	Burma	10	1	2	2
Colombia	13	--	7	4	China	79	9	6	9
Costa Rica	5	--	2	1	India	13	3	1	2
Dominican Republic	4	--	1	3	Indonesia	6	--	1	1
Ecuador	13	1	5	3	Japan	1	--	--	--
Guatemala	15	--	3	--	Korea, South	4	--	2	4
Guyana	2	--	--	--	Nepal	14	--	2	--
Paraguay	15	--	4	1	Pakistan	37	12	9	6
Peru	26	20	15	5	Philippines	17	2	4	1
Uruguay	10	1	1	--	Sri Lanka	4	--	--	1
Venezuela	2	--	1	--	Taiwan	5	--	--	2
					Thailand	17	5	4	3
<b>Africa</b>	<b>247</b>	<b>90</b>	<b>58</b>	<b>54</b>	<b>Oceania</b>	<b>23</b>	<b>9</b>	<b>11</b>	<b>4</b>
Algeria	16	12	2	5	Australia	16	4	6	2
Angola	1	1	1	1	New Zealand	7	5	5	2
Burkina Faso	5	--	--	--	<b>Europe</b>	<b>166</b>	<b>98</b>	<b>96</b>	<b>58</b>
Burundi	3	--	1	--	Albania	2	1	1	--
Cameroon	6	1	2	1	Austria	--	3	--	1
Congo	2	--	--	--	Belgium	1	--	--	--
Egypt	24	18	8	6	Bulgaria	5	6	3	--
Ethiopia	15	8	3	4	Czechoslovakia	5	--	2	2
Kenya	15	6	4	5	England	6	1	6	3
Libya	7	5	--	2	Finland	1	--	--	1
Malawi	7	--	2	2	France	11	3	9	6
Morocco	18	6	2	1	German D. Rep.	--	--	2	1
Mozambique	6	3	4	1	Germany, F. Rep.	4	8	4	3
Niger	1	1	1	1	Greece	11	10	6	6
Nigeria	6	--	--	1	Hungary	3	2	2	1
Rwanda	8	--	3	2	Ireland	5	--	--	5
Senegal	3	1	--	--	Italy	9	18	4	6
Somalia	1	--	--	--	Netherlands	5	--	--	--
South Africa	20	8	7	7	Norway	4	--	2	2
Sudan	14	5	2	1	Poland	10	1	7	4
Swaziland	3	--	1	--	Portugal	15	8	7	5
Tanzania	16	3	5	3	Rumania	5	1	6	1
Tunisia	10	12	4	6	Spain	39	33	29	11
Uganda	6	--	1	--	Sweden	6	--	4	--
Zaire	4	--	1	--	Switzerland	2	1	1	--
Zambia	17	--	4	--	USSR	7	--	--	--
Zimbabwe	13	--	--	5	Yugoslavia	10	2	1	--
<b>Mideast</b>	<b>140</b>	<b>89</b>	<b>43</b>	<b>51</b>	<b>TOTAL TRIALS</b>	<b>1,094</b>	<b>403</b>	<b>322</b>	<b>233</b>
Cyprus	6	6	3	3	<b>TOTAL COUNTRIES</b>	<b>92</b>	<b>58</b>	<b>75</b>	<b>67</b>
Iran	10	--	2	3					
Iraq	6	6	4	4					
Israel	19	9	3	4					
Jordan	9	13	6	3					
Lebanon	6	3	1	--					
Quatar	3	--	--	2					
Saudi Arabia	7	3	2	2					
Syria	30	19	10	12					
Turkey	35	28	11	18					
Yemen, South	5	1	--	--					
Yemen, North	4	1	1	--					

# In-Service Training

## Appendix II Origin of maize in-service trainees, 1971-84

Region and country	1971-84	1984	Region and country	1971-84	1984
<b>Central America, Mexico and Caribbean</b>	<b>231</b>	<b>22</b>	<b>Asia (Cont'd)</b>		
Belize	6	0	Nepal	24	0
Costa Rica	15	3	Pakistan	44	1
Cuba	3	1	Philippines	27	1
Dominica	1	0	Thailand	49	10
Dominican Republic	18	1	Vietnam	6	2
El Salvador	26	1	<b>North Africa and Mideast</b>	<b>52</b>	<b>6</b>
Grenada	1	0	Algeria	1	0
Guatemala	23	3	Egypt	25	4
Guyana	1	0	Iran	1	1
Haiti	18	0	Syria	2	0
Honduras	30	2	Tunisia	3	0
Jamaica	1	0	Turkey	17	1
Mexico	43	8	Yemen A.R.	3	0
Nicaragua	25	1	<b>Sub-Saharan Africa</b>	<b>206</b>	<b>19</b>
Panama	17	2	Benin	2	1
<b>South America</b>	<b>107</b>	<b>12</b>	Botswana	2	0
Argentina	11	0	Cameroon	4	0
Bolivia	12	0	Cape Verde	1	0
Brazil	4	1	Congo	1	0
Colombia	15	1	Ethiopia	8	2
Chile	2	0	Ghana	32	3
Ecuador	23	3	Guinea-Bissau	3	2
Paraguay	3	2	Ivory Coast	5	1
Peru	29	5	Kenya	13	4
Venezuela	8	0	Lesotho	1	1
<b>Asia</b>	<b>200</b>	<b>17</b>	Mali	1	0
Afghanistan	6	0	Malawi	6	0
Bangladesh	13	0	Mozambique	3	0
Burma	1	0	Nigeria	15	0
India	10	0	Rwanda	2	1
Indonesia	8	3	Senegal	3	1
Japan	7	0	Somalia	3	3
Korea	2	0	Swaziland	1	0
Malaysia	3	0	Tanzania	55	0
			Transkei	1	0
			Uganda	3	0
			Zaire	32	0
			Zambia	9	0
			<b>Other</b>	<b>3</b>	<b>0</b>
			<b>TOTAL TRAINING FELLOWS</b>	<b>799</b>	<b>76</b>
			<b>TOTAL COUNTRIES</b>	<b>71</b>	<b>32</b>

**Appendix II (cont'd)**  
**Origin of wheat in-service trainees, 1966-84**

	1966- 1984	1984		1966- 1984	1984
<b>Latin America</b>	<b>220</b>	<b>19</b>	<b>Sub-Saharan Africa</b>	<b>101</b>	<b>5</b>
Argentina	16	1	Burundi	1	0
Bolivia	24	1	Cameroon	1	0
Brazil	20	1	Chad	1	0
Chile	13	0	Ethiopia	20	2
Colombia	8	1	Kenya	13	0
Dominican Republic	3	0	Lesotho	2	0
Ecuador	24	3	Madagascar	2	0
Guatemala	13	2	Malagasy	1	0
Guyana	2	0	Malawi	3	0
Honduras	1	0	Mali	3	0
Mexico	53	6	Mozambique	1	0
Panama	1	0	Nigeria	18	1
Paraguay	8	0	Rwanda	2	0
Peru	33	4	Senegal	2	0
Uruguay	1	0	Somalia	1	0
			Tanzania	13	2
<b>North Africa and Mideast</b>	<b>216</b>	<b>2</b>	Transkei	1	0
Algeria	54	0	Uganda	1	0
Cyprus	2	0	Zaire	2	0
Egypt	15	0	Zambia	7	0
Iran	9	0	Zimbabwe	2	0
Iraq	5	0			
Jordan	7	0	<b>Asia</b>	<b>210</b>	<b>19</b>
Lebanon	4	0	Afghanistan	13	0
Libya	4	0	Bangladesh	49	4
Morocco	22	2	Burma	2	0
Saudi Arabia	2	0	India	18	0
Sudan	3	0	Korea	18	3
Syria	8	0	Nepal	21	2
Tunisia	28	0	Pakistan	66	5
Turkey	50	0	Philippines	11	2
Yemen	3	0	Sri-Lanka	2	0
			Thailand	9	2
			Viet Nam	1	1
			<b>Other Countries</b>	<b>28</b>	<b>3</b>
			France	1	0
			Hungary	2	0
			Norway	1	0
			Poland	5	2
			Portugal	4	0
			Rumania	2	0
			Spain	5	1
			USA	4	0
			USSR	4	0
			<b>TOTAL TRAINING FELLOWS</b>	<b>775</b>	<b>48</b>
			<b>TOTAL COUNTRIES</b>	<b>71</b>	<b>21</b>

## Appendix III Publications Released by CIMMYT in 1984

	Language	Pages	Press Run
<b>Administration</b>			
This is CIMMYT	French	48	1,500
CIMMYT and Mexico	English	20	1,500
	Spanish	20	2,000
Visitor's Guide to CIMMYT	English	12	2,000
	Spanish	12	1,000
	French	12	1,000
CIMMYT 1983 Annual Report	English	72	2,750
	Spanish	72	2,500
Training at CIMMYT	French	28	1,000
CIMMYT 1983 Research Highlights	English	88	7,000
A New Training, Conference and Information Facility for CIMMYT	English	8	850
Biennial Budget Request 1985-86	English	48	1,000
Compendium of Selected Meteorological Data for the El Batan, Poza Rica, Tlaltizapan and Toluca Experiment Stations	English	100	500
Growing Degree Days: A Compendium of Data for the El Batan, Poza Rica, Tlaltizapan and Toluca Experiment Stations	English	30	500
<b>Maize</b>			
Techniques for Efficient Mass Rearing and Infestation in Screening for Host Plant Resistance to Corn Earworm, <i>Heliothis Zea</i>	Spanish	24	1,000
Efficient Mass-Rearing and Infestation Techniques to Screen for Host Plant Resistance to Maize Stem Borers, <i>Diatraea Sp.</i>	Spanish	28	1,000
Efficient Mass-Rearing and Infestation Techniques to Screen for Host Plant Resistance Fall Armyworm,	Spanish	24	1,000
Maize Diseases: A Guide for Field Identification 3rd Edition	English	120	10,000
	Spanish	120	7,000
Maize International Testing Program 1983, Preliminary Report	English	282	750
Breeding and Selection for Drought Resistance	Spanish	28	2,000
Development, Maintenance, and Seed Multiplication of Open-Pollinated Maize Varieties	English	20	3,000
	Spanish	20	2,000
<b>Wheat</b>			
CIMMYT Report on Wheat Improvement, 1981	English	148	2,500
CIMMYT Report on Wheat Improvement, 1982	English	185	3,000
Common Diseases of Small Grain Cereals	Spanish	156	3,500
A Guide to Identification	French	156	2,000
Barley Yellow Dwarf Workshop Proceedings	English	209	5,000
Characteristics of Selected Seed-Borne Fungi (Poster)	English		5,000
	Spanish		3,000
	French		2,000
Semidwarf Bread Wheats-Names, Parentage, Pedigrees, Origin	English	40	3,000
	Spanish	40	2,000
<b>Economics</b>			
1984 CIMMYT Maize Facts & Trends, Report Two: An analysis of changes in Third World food and feed uses of maize	English	48	7,000

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## Appendix III (Cont'd)

	Language	Pages	Press Run
<b>Working Paper Series:</b>			
Creating an On-Farm Research Program in Ecuador	Spanish	36	750
The Increasing Role of Wheat Consumption and Imports in the Developing World	English	100	750
Exercises in the Economics Analysis of Agronomic Data	Spanish	76	750
Recommendation Domains: A Framework for On-Farm Research	English	38	1,000
	Spanish	38	750
Data Collection, Site Selection and Farmer Participation in On-Farm Experimentation	Spanish	52	750

## Scientific Journal Articles (and monographs/book chapters)

P.A. Burnett

"Cereal crop pests". In *New Zealand Pests and Beneficial Insects*. Ed. R.R. Scott, 373 pp. Lincoln University College of Agriculture. 1984.

D. Byerlee and L.W. Harrington

"New wheat varieties and the small farmers". In *Rural Development: Growth and Equity*. B.L. Greenshields and M.A. Bellamy (eds). International Agric. Econ. Assoc. Grower Publishing Co. Haunts, U.K. 1984.

D. Byerlee

"Autarky in food: evidence and prospects, comments." *Pakistan Development Review*, XXIII, 2-3, pp. 269-271. 1984.

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"The farming systems perspective and farmer participation in the development of appropriate technology." *Agriculture Development in the Third World*. C.K. Eicher and J. Staatz (eds.) John Hopkins University Press. 1984.

J.M. Due and P. Anandajayasekeram

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"Tropical maize." In *The Physiology of Tropical Field Crops*. P.R. Goldsworthy and N.M. Fischer (eds). pp. 213-248, John Wiley and Sons. 1984.

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- A. Mujeeb-Kazi, S. Roldan, and J.L. Miranda  
"Intergeneric hybrids of *Triticum aestivum* L. with *Agropyron* and *Elymus* species." *Cer. Res. Comm.* 12:75-79. 1984.
- A. Mujeeb-Kazi and J.L. Miranda  
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"*Hordeum vulgare* x *Triticum aestivum* hybrids." *Cytologia* 49:557-565. 1984.
- A. Low  
"Agricultural development in southern Africa: theory, lessons and the food crisis in Africa." *Development Southern Africa* Vol. 1, No's. 3 & 4. November 1984.
- J.L. Miranda, V. Rosas, S. Roldan, and A. Mujeeb-Kazi  
"Exploitation of some salt tolerant alien sources for *Triticum aestivum* L. improvement." *Agronomy Abstr.* p. 79. 1984.
- S. Nagarajan, G. Seibold, J. Kranz, E.E. Saari, and L.M. Joshi  
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- S. Nagarajan, J. Kranz, E.E. Saari, G. Seibold, R. Stubbs, and J.C. Zadoks  
"An analysis of the 1978 epidemic of yellow rust on wheat in Andalusia, Spain." *Zeitschrift für Pflanzenkrankheiten and Pflanzenschutz* 91:159-170. 1984.
- R. Ortíz B. and E. Torres  
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- R. Tripp  
"On-farm research and applied nutrition." *Food and Nutrition Bulletin* 6(3):49-57. 1984.
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E.J. Warham, A. Mujeeb-Kazi, and V. Rosas  
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## Conference and Seminar Presentations

### Asia

H.J. Dubin  
"Philosophy of CIMMYT's wheat breeding program with special emphasis on pathology." All-India Wheat Workshop. Kanpur, India. August 1984.

L.W. Harrington, S. Sat-thaporn, and Ch. Chavewong  
"Growing wheat in Thailand: an overview of economic issues." Annual Wheat Workshop. Thailand. January 1984.

L.W. Harrington  
"Farming systems research: the need for a practical approach." The First National Farming Systems Workshop. Thailand. April 1984.

L.W. Harrington, R. Thiraporn, and S. Wattanutchariya  
"The profitability of new maize technology: an economic analysis of 1983 on-farm verification trials." 15th Thai National Corn and Sorghum Reporting Session. Thailand. April 1984.

L.W. Harrington  
"Assessing farmers' economic circumstances: applications in crop production research and micro-level policy research." ESCAP CGPRT Expert Group Meeting on Research Implications of Expanded Production of Selected Upland Crops in Tropical Asia. Thailand. November 1984.

R.D. Havener  
"Strengthening national agricultural research organizations: some lessons learned by CIMMYT." ISNAR Regional Workshop on Potential for Strengthening Management in National Agricultural Research. Amman, Jordan. October 1984.

A. Mujeeb-Kazi and D.C. Jewell  
"Wide crosses at CIMMYT for wheat and maize improvement." Inter-Center Seminar on IARCs and Biotechnology. IRRI. Los Baños, The Philippines. 23-27 April 1984.

C.E. Mann and E.E. Saari  
"Wheat breeding objectives for tropical environments." The Thai Annual Wheat Workshop. Thailand. January 1984.

B.L. Renfro  
"The results of the CIMMYT collaborative program with Thailand." 15th Thai National Corn and Sorghum Workshop. Thailand. April 1984.

B.L. Renfro  
"A seed production scheme designed for open-pollinated maize varieties." Kasetsart University ASPAC-FFTC Seminar on Seed Production of Selected Crops. Thailand. May 1984.

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E.E. Saari

"Potential areas for wheat cultivation in tropical environments." The Thai Annual Wheat Workshop. Thailand. January 1984.

D.A. Saunders

"Agronomic constraints to wheat cultivation in tropical environments." The Thai Annual Wheat Workshop. Thailand. January 1984.

### **Africa**

M.P. Collinson

"On-farm research with a systems perspective as a link between farmers, technical research and extension." African Workshop on Extension and Research. Kenya. June 1984.

B. Gelaw

"Maize research and production in sub-Saharan Africa." The Association of Faculties of Agriculture in Africa (AFAA) 5th General Conference. Swaziland. April 1984.

A. Low

"On-farm research and food security in southern Africa." AFAA 5th General Conference on Food Security in Africa. Swaziland. April 1984.

J.A. Mihm

"Breeding for host plant resistance to maize stem borers." ICIPE. Nairobi, Kenya. June 1984.

A.F.E. Palmer

"Nitrogen and phosphorus responses and yield trends for continuous maize grown under conservation tillage in the lowland tropics." International Symposium on Nitrogen Management in Farming Systems in the Tropics. IITA, Ibadan, Nigeria. October 1984.

Joel Ransom

"The importance of agronomic practices in maximizing wheat yields." International Conference on Wheat and Potatoes. Madagascar. 1984.

E. Torres

"Impact of innovative wheat improvement upon wheat production." The Association of Faculties of Agriculture in Africa (AFAA) 5th General Conference. Swaziland. April 1984.

E. Torres

"National and international aspects of screenings for disease resistance in wheat." International Conference on Wheat and Potatoes. Madagascar. 1984.

### **Latin America**

A. Amaya

"Screening wheats for quality." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.

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G.T. Bekele

"Wheat scab screening methods at CIMMYT." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.

M. Bjarnason

"Approaches in breeding for streak resistance." U.S. Universities/CIMMYT Maize Conference. Mexico. August 1984.

N.E. Borlaug and M.A. McMahon

"The role of the agricultural sector in the economic recovery of Argentina." Secretary of Agriculture. Argentina. 1984.

L. Butler

"Wheat varietal development strategy in Bangladesh." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.

D. Byerlee

"Wheat in the tropics: economics and policy issues." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.

M. Caviedes and S. Taba

"Reporte sobre varios genotipos de maíz de tierras altas en el Ecuador." XI Reunión de Maiceros de la Zona Andina. December 1984.

H.S. Córdoba

"Formación de híbridos de maíz (*Zea mays* L.) en base a familias de hermanos completos y sus implicaciones en la producción de semilla comercial." XV Congreso Nacional de Milho e Sorgo. Maceio, Brazil. July 1984.

H.S. Córdoba

"Integración de los programas de mejoramiento al proceso de generación, prueba y transferencia de tecnología: El programa de maíz del ICTA y su impacto en la producción de maíz en Guatemala." XI Reunión de Maiceros de la Zona Andina, II Reunión Lationamericana del maíz, Palmira, Colombia. 1984.

W.A.J. De Milliano

"The effect of early foliar infection by *Helminthosporium sativum* on some yield components of two African wheats." Symposium on Wheats for the More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.

W.A.J. De Milliano and H. Van Keulen

"Simple simulation models for agronomic research." Symposium on Wheats for the More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.

H.J. Dubin

"Reflections on root rots of wheat in warmer, non-traditional, wheat-growing climates." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.

M. Eliassaint, M. Yates, H.S. Córdoba, J.C. Martínez

"Tercera fase en el desarrollo de alternativas tecnológicas apropiadas para la producción de maíz en Les Cayes, Haití." XXX Reunión Anual del PCCMCA, Managua, Nicaragua. 1984.

- J. Equez, S. Taba, F. Moreno, M. Galarza and J. Rivadeneira  
 "Resultados de ensayos a nivel de finca de variedades de maíz de zona alta con pequeños agricultores en Ecuador." XI Reunión de Maiceros de la Zona Andina. December 1984.
- L.I. Gilchrist  
 "Methods for screening wheat for *Helminthosporium sativum* resistance at CIMMYT." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.
- M. Guler  
 "Wheat production constraints and management in Bangladesh." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.
- L.W. Harrington  
 "Wheat in Chiang Rai, Thailand: a preliminary look at comparative advantage." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.
- A. Hibon  
 "Investigación en campos de agricultores: énfasis en planificación de tecnología y análisis económico de datos agronómicos." Curso de Orientación para Aspirantes a Investigadores de INIP, INIF e INIA. La Calera, Zacatecas, Mexico, July, 1984.
- P.R. Hobbs  
 "Agronomic practices and problems for wheat following cotton and rice in Pakistan." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.
- C. Janies  
 "Phytopathological components of maize breeding program." 25 Aniversario del Colegio de Postgraduados de Chapingo. Mexico. December 1984.
- A. Mujeeb-Kazi  
 "Wide crosses and new genes for the tropics." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.
- M.M. Kohli  
 "Identifying wheats adapted to more tropical areas of the Southern Cone of South America." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.
- C.E. Mann  
 "Selecting and introducing wheats for the environments of the tropics." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.
- M.A. McMahon  
 "Algunas opiniones sobre la cosecha Trigo 1983-84." Secretary of Agriculture. Chile. January 1984.

M.A. McMahon and W.J. Goedert

"The cerrados: future wheat prospects and limitations." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.

M.A. McMahon

"Wheat agronomy in the Southern Cone of Latin America." Cereal Breeding and Production Symposium. Argentina. November 1984.

J.A. Mihm

"Studies on *Diatraea* sp. maize stem borers and the maize weevil, *Sitophilus zeamais*, in CIMMYT." Regional Meeting for Integrated Pest Management. Pan American Agricultural School. El Zamorano, Honduras. April 1984.

H. Muhtar

"History of zero tillage equipment." Primer Simposium Nacional sobre Sistemas de Labranza, sponsored by SARH. México. May 1984.

H. Muhtar

"Conservation tillage and direct drill planting on a small-scale farm." Seminario Labranza de Conservación en la Pequeña Propiedad at the University of Chapingo. México. September 1984.

S. Pandey, C. De León and G. Granados

"Mejoramiento de maíz mediante ensayos internacionales." XI Reunión de Maiceros de la Zona Andina y II Reunión Latinoamericana del Maíz. Palmira, Colombia. December 1984.

J.M. Prescott

"A review of major wheat diseases in tropical environments." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.

R. Rodríguez Sosa, R. Mena, M. Manzano, N. Navarrete, H.S. Córdova

"Evaluación de cruces triples de maíz (*Zea mays* L.) provenientes de poblaciones resistentes al achaparramiento." XXX Reunión Anual del PCCMCA, Managua. Nicaragua. April 1984.

E.E. Saari

"Chemical control measures for the major diseases of wheat with special attention to spot blotch." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.

S. Taba

"Programa de maíz harinoso del CIMMYT en 1983-84." XI Reunión de Maiceros de la Zona Andina. December 1984.

G. Varughese

"Wheat in West Africa." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.

S.K. Vasal

"Approaches and methodology in the development of QPM hybrids." XV Congreso Nacional de Milho e Sorgo. Macefo, Brazil. July 1984.

R.L. Villareal, S. Rajaram, and W. Nelson

"Breeding wheat for more tropical environments at CIMMYT." Symposium on Wheats for More Tropical Environments. CIMMYT. Mexico City, Mexico. September 1984.

A.D. Violic, A.F.E. Palmer, and F. Kocher

"Control de malezas en maíz: experiencias del CIMMYT en labranza de conservación en el trópico bajo de Veracruz, México." XXX Reunión Anual del PCCMCA. Managua, Nicaragua. April 1984.

H. Vivar and P. Burnett

"Barley breeding in Mexico for disease resistance." Andean Barley Workshop. Bogotá, Colombia. June 1984.

P.C. Wall

"Utilidad, filosofía y conducta de la investigación integrada a nivel de finca." Universidad Nacional Agraria La Molina. Peru. 1984.

### **North America**

P. Anandajayasekeram

"Research extension linkage: the case of Kenya." Farming Systems Symposium. Kansas State University. Kansas. October 1984.

P.A. Burnett, H. Vivar, J.P. Neuhaus-Steinmetz, and F. Gonzáles

"Disease screening in the CIMMYT barley breeding program." 12th American Barley Researchers Workshop. Williamsburg, Virginia., U.S.A. January 1984.

M.P. Collinson

"Farming systems research: diagnosing the problem." World Bank Annual Agricultural Symposium. Washington, D.C. January 1984.

B.C. Curtis

"Increasing wheat production in the 1980s: the perspective of an international plant breeding institute." International Meeting of Gamma Sigma Delta. Colorado State University. Fort Collins, Colorado, USA. June 1984.

H.J. Dubin, P.C. Wall, C. Cazco, and A. Figueroa

"Yield losses in wheat attributable to barley yellow dwarf virus in the Ecuador Highlands." American Society of Agronomy. Las Vegas, Nevada. November 1984.

H.J. Dubin

"*Puccinia striiformis* f. sp. *hordei*: cause of yellow rust epidemic in South America." American Phytopathological Society. Guelph, Canada. August 1984.

R.D. Havener

"Is the green revolution still green?" Grant F. Walton International Lecture Series on Agriculture and Environmental Affairs. Rutgers University. New Jersey. October 1984.

C. James

"Future role of technology with respect to grains with special emphasis on wheat." Centennial Forum, 100th Session of International Wheat Council. Ottawa, Canada. June 1984.

J.A. Mihm

"Methods of artificial infestation with *Diatraea* species and evaluation of stem borer resistance in sorghum." International Sorghum Entomology Workshop. Texas A&M. College Station, Texas. July 1984.

M. Osmanzai, J.K. Ransom, S.R. Waddington, and M. Yoshida

"Performance of complete and substituted triticale in stress and no stress environments." American Society of Agronomy. Las Vegas, Nevada. November 1984.

S. Rajaram, B. Skovmand, and B.C. Curtis

"Philosophy and methodology of an international wheat breeding program." Stadler Genetics Symposium. University of Missouri. Columbia, Missouri, USA. January, 1984.

S.R. Waddington, J.K. Ransom, M. Osmanzai, and D.A. Saunders

"Genotypic variability for grain growth in triticale." American Society of Agronomy. Las Vegas, Nevada. November 1984.

P.C. Wall, M.A. McMahon, and J.K. Ransom

"Do semidwarf wheats require more nitrogen than traditional tall varieties?" American Society of Agronomy. Las Vegas, Nevada. November 1984.

E.J. Warham and J.M. Prescott

"Effect of chemicals on teliospore germination of Karnal bunt, *Neovossia indica*." American Phytopathological Society. Guelph, Canada. August 1984.

E.J. Warham

"A comparison of inoculation methods for Karnal bunt, *Neovossia indica*." American Phytopathological Society. Guelph, Canada. August 1984.

E.J. Warham, A. Mujeeb-Kazi, and V. Rosas

"Screening of *Aegilops* species for Karnal bunt (*Neovossia indica*) and their practical utilization for *Triticum aestivum* improvement." American Society of Agronomy. Las Vegas, Nevada. November 1984.

## Europe

A. Amaya and B. Skovmand

"Industrial quality improvement in hexaploid triticales." Eucarpia Third Meeting on Triticale. Clermont-Ferrand, France. 1984.

G.T. Bekele, B. Skovmand, L.I. Gilchrist, and E.J. Warham

"Screening triticales for resistance to certain diseases occurring in Mexico." Eucarpia Third Meeting on Triticale. Clermont-Ferrand, France. 1984.

M. Bjarnason, G.O. Edmeades, and A. Ortega

"Improvement of some important traits of tropical maize." Expert Consultation on Breeding Strategies for Maize Production Improvement in the Tropics. Italy. September 1984.

C. James

"CIMMYT's progress in crop improvement." Faculty of Agriculture and Forestry. Helsinki, Finland. February 1984.

A. Low

"On-farm research and household economics." Presented at The Rockefeller/Ford Foundation Conference on Intra-Household Processes and Farming Systems Analysis. Italy. March 1984.

H. Muhtar

"A direct drill row-crop planter for developing countries." Sixth International Conference on Mechanization of Field Experiments (IAMFE 6). Ireland. July 1984.

B.L. Renfro

"Breeding for disease resistance in tropical maize and its genetic control." FAO Expert Consultation on Breeding Strategies for Maize Production Improvement in the Tropics. Italy. September 1984.

B. Skovmand, H.J. Braun, and P.N. Fox

"Comparison of agronomic and quality characteristics of complete and substituted hexaploid spring triticules." Eucarpia Third Meeting on Triticale. Clermont-Ferrand, France. 1984.

S.K. Vasal, E. Villegas, and C.Y. Tang

"Recent advances in the development of quality protein maize germplasm at CIMMYT. Cereal Grain Protein Improvement Conference. International Atomic Energy Agency. Vienna. 1984.

## **Oceania**

C.E. Mann and E.E. Saari

"Breeding wheat for tropical environments." The Fourth Assembly of the Wheat Breeding Society of Australia. Toowoomba, Queensland. 1984.



México, D.F., February 8, 1985

To the Board of Trustees of  
Centro Internacional de Mejoramiento  
de Maíz y Trigo, A.C.

In our opinion, the accompanying statements of condition and the related statements of activity and of changes in financial position on a cash basis, expressed in United States dollars, present fairly the financial position of Centro Internacional de Mejoramiento de Maíz y Trigo, A.C. (CIMMYT) at December 31, 1984 and 1983, and the results of its operations and the changes in its financial position for the years then ended, in conformity with accounting principles generally accepted in the United States of America for not-for-profit organizations consistently applied. Our examinations of these statements were made in accordance with generally accepted auditing standards and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

Our examinations were made primarily for the purpose of forming our opinion on the financial statements taken as a whole. We also examined the additional information presented on Exhibits 1 to 4, expressed in United States dollars, by similar auditing procedures. In our opinion, this additional information is stated fairly in all material respects in relation to the financial statements taken as a whole. Although not necessary for a fair presentation of financial position, results of operations and changes in financial position, this information is presented as additional data.

PRICE WATERHOUSE

A handwritten signature in dark ink, appearing to read "C.P. Oscar Córdova".

C.P. Oscar Córdova

## Statement of Condition

### Centro Internacional de Mejoramiento de Maíz y Trigo, A.C.

Assets	Currency: U.S. Dlls. (000's)	
	As of December 31	
	1984	1983
<b>Current Assets:</b>		
Cash on Hand and in Banks	791	732
Short-Term Investments (Note 2)	2,867	3,084
	3,658	3,816
Accounts Receivable (Note 6)		
Donors	1,437	2,118
Others	429	331
	1,866	2,449
Inventories	213	106
Total Current Assets	5,737	6,371
<b>Fixed Assets (Note 2)</b>		
Vehicles	2,906	2,879
Furniture, Fixtures and Equipment	4,169	3,465
Buildings	6,356	5,993
Land	464	464
Other Fixed Assets	369	369
Total Fixed Assets	14,264	13,170
<b>Other Assets</b>		
Work in Progress	9	
Guarantee Deposits	1	1
Total Other Assets	10	1
<b>Total Assets</b>	<b>20,011</b>	<b>19,542</b>

The attached notes numbered 1 to 6 form an integral part of these Financial Statements.

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## **Liabilities, Capital Grants, Unexpended Funds and Reserves**

	As of December 31	
	1984	1983
<b>Current Liabilities:</b>		
Payments in Advance--Donors (Note 6)	1,549	1,421
Vouchers Payable	2,705	3,133
Seniority Premiums (Note 2)	112	77
Accrued Taxes	272	145
Accrued Miscellaneous Expenses	2	7
<b>Total Current Liabilities</b>	<b>4,640</b>	<b>4,783</b>
<b>Capital Grants, Unexpended Funds and Reserves</b>		
<b>Capital</b>		
Fully Expended on Fixed Assets (Note 2)	14,264	13,170
Operating Funds (Note 4)	1,540	1,540
	15,804	14,710
<b>Unexpended Funds</b>		
Core Unrestricted	812	808
Core Restricted	19	19
Extra Core and Cooperative Projects	(48)	(48)
Auxiliary Services	65	248
Translation Effect (Note 3)	(1,373)	(1,070)
	(525)	(43)
Trustees Reserve	92	92
<b>Total Capital Grants, Unexpended Funds and Reserves</b>	<b>15,371</b>	<b>14,759</b>
<b>Total Liabilities and Capital</b>	<b>20,011</b>	<b>19,542</b>

The attached notes numbered 1 to 6 form an integral part of these Financial Statements.

## Comparative Statement of Activity

### Centro Internacional de Mejoramiento de Maíz y Trigo, A.C.

Revenue and Expenses	Currency: U.S. Dlls. (000's)	
	Year ended December 31	
	1984	1983
<b>Revenue (Note 5)</b>		
Grants	23,705	19,940
Administrative Fees	1,096	848
Sale of Crops	22	17
Interest on Short-Term Investments	508	386
Auxiliary Services	629	636
Other Income	2	26
<b>Total Revenue</b>	<b>25,962</b>	<b>21,853</b>
<b>Expenses (Note 5)</b>		
Research Programs	16,501	13,578
Conferences and Training	3,482	3,117
Information Services	789	662
General Administration	1,504	1,669
Plant Operations	1,475	1,056
Capital Acquisitions	607	269
Auxiliary Services	637	404
Indirect Costs	1,096	848
Seniority Premiums	50	10
<b>Total Expenses</b>	<b>26,141</b>	<b>21,613</b>
<b>(Deficit) Excess of Revenue over Expenses</b>		
<b>before Translation Effect</b>	(179)	240
Translation Effect for the Year (Note 3)	(303)	(108)
<b>Net (Deficit) Excess of Revenue over Expenses</b>	<b>(482)</b>	<b>132</b>
Unexpended Funds, Opening Balance	(43)	(175)
Closing Balance Unexpended Funds as per Statement of Condition	(525)	(43)

The attached notes numbered 1 to 6 form an integral part of these Financial Statements

## Statement of Changes

### Centro Internacional de Mejoramiento de Maíz y Trigo, A.C.

In Financial Position on a Cash Basis	Currency: U.S. Dlls. (000's)	
	Year ended December 31	
	1984	1983
<b>Sources of Cash</b>		
Revenue	25,962	21,853
Capitalization of Fixed Assets Purchased during the Year		
Core Unrestricted Grants	1,094	647
Core Restricted Grants	—	21
Extra Core Grants	—	20
Translation Effect of the year-Net	(303)	(108)
	26,753	22,433
Accounts receivable-Donors	681	—
Accounts receivable Others	—	122
Payments in advance-Donors	128	1,207
Accrued taxes	127	145
Accrued miscellaneous expenses	—	7
Seniority premiums	35	—
	27,724	23,914
<b>Applications of Cash</b>		
Expenses	26,141	21,613
Purchases of fixed assets		
Core Unrestricted Grants	1,094	647
Core Restricted Grants	—	21
Extra Core Grants	—	20
Accounts Receivable-Donors	—	811
Accounts Receivable Others	98	—
Inventories	107	28
Vouchers payable	428	159
Seniority premiums	—	10
Accounts Payable-Donors	—	42
Accrued miscellaneous expenses	5	—
Other Assets	9	—
	27,882	23,351
(Decrease) Increase in Cash and in Short-Term Investments	(158)	563
Cash and Short-Term Investments on hand at beginning of year	3,816	3,253
Cash and Short-Term Investments at end of year	3,658	3,816

The attached notes numbered 1 to 6 form an integral part of these Financial Statements.

December 31, 1984 and 1983  
U.S. Dollars

### Note 1 — Statement of Purpose.

The Centro Internacional de Mejoramiento de Maíz y Trigo, A. C. (CIMMYT) is a private, autonomous, not-for-profit, scientific and educational institution chartered under Mexican law to engage in the improvement of maize and wheat production everywhere in the world, with emphasis on developing countries.

### Note 2 — Summary of significant accounting policies.

CIMMYT follows accounting policies recommended by the Secretariat of the Consultative Group on International Agricultural Research (CGIAR), an international association sponsored by the World Bank, the Food and Agriculture Organization of the United Nations, and the United Nations Development Programme. These policies are in accordance with accounting practices generally accepted in the United States of America for not-for-profit organizations and are summarized below:

a. CIMMYT uses the accrual method of accounting for transactions and its books of account are kept in U.S. dollars. Transactions in other currencies (mainly Mexican pesos) are recorded at the rates of exchange prevailing on the dates they are entered into and settled. Assets and liabilities denominated in such currencies are translated into U.S. dollars applying Statement No. 52 of the Financial Accounting Standards Board of The United States of America (FAS 52). In accordance with that statement CIMMYT has adopted the U.S. dollar as its "functional currency"

in consideration that the Mexican economy has been hyper-inflationary, i.e. with a cumulative inflation rate for the three last years greater than 100 percent as measured by the National Consumer Price Index published by Banco de México.

b. Purchase orders issued prior to December 15 are treated as operating expenses of the year in question and are shown on the statement of condition under vouchers payable. This is in accordance with guidelines issued by the Secretariat of the Consultative Group on International Agricultural Research (CGIAR).

c. During periods of cash surplus CIMMYT makes short-term investments in marketable securities. Those denominated in dollars are transacted in the U.S. money market. Interest is credited to income when the security matures or is sold. The security is recorded at cost, which approximates market, and any gain or loss from its sale is recorded at that time. Investments in pesos are held in a short-term interest-bearing account in a Mexican bank or in government securities. Interest is credited to income as accrued.

d. Inventories are stated at cost (first-in, first-out method), which is not in excess of market.

e. Fixed Assets are stated at acquisition cost. Up to 1971 all purchases of property and equipment were recorded as expenses. In 1972 the CGIAR requested that the International Agricultural Research Centers change to the "write off, then capitalize" method of recording purchases of property and equipment. Accordingly, all property and equipment purchased under capital grants as from January 1, 1972, was recorded as an asset and credited to capital grants. Prior to 1980

replacements of capital items were recorded as expenditures of the related programs, and did not enter in any way to form part of CIMMYT's capital grants, shown on the statement of condition. In 1980, this policy was revised to conform with the accounting policies of the CGIAR. Under this set of guidelines, the incremental value of a capital replacement item, i.e., the amount by which the historical cost of the replacement item is greater (less) than the historical cost of the item being replaced, is credited (debited) to capital grants fully expended on fixed assets. In this way, the statement of condition reflects the historical cost of the fixed assets actually in use.

CIMMYT's buildings at certain locations in Mexico are constructed on land owned by the Mexican government, and will be donated to the government when CIMMYT ceases operations in Mexico.

f. Depreciation — In accordance with the "write off, then capitalize" method, no depreciation is provided since the assets have already been written off at the time of purchase.

g. Seniority premiums, to which employees are entitled upon termination of employment after fifteen years of service, are recognized as expenses as such premiums accrue. The estimate of the accrued benefit determined on the basis of an actuarial study as of the year end amounted to U.S. \$ 197,000 in 1984 (U.S. \$ 150,000 in 1983) and CIMMYT has recorded a liability of U.S. \$ 112,000 in 1984 (U.S. \$ 77,000 in 1983). The charge to income for the year amounted to U.S. \$ 50,000 in 1984 (U.S. \$ 10,000 in 1983) including amortization of past service cost over 10 years.

Other compensation based on length of service, to which employees may be entitled in the event of dismissal or death, in accordance with the Mexican Federal Labor Law, is charged to income in the year in which it becomes payable.

h. Income Recognition: Core unrestricted grants are given annually and are charged to accounts receivable when the amount of the donation becomes known. The receivable is cancelled when the funds are received. Any uncollected portion of the pledge applicable to the current year remains charged to accounts receivable and forms part of the institution's income in that year. If the pledge is later judged to be uncollectible it is written off against income of the year in which it is cancelled.

Pledges in currencies other than U.S. Dollars are recorded at their equivalent at the date of deposit.

Core restricted and extra core pledges, which are often for more than one year, are treated somewhat differently. In these cases the amount recognized as a receivable is equal to the expenses incurred under the grant. The uncollected portion of the pledge is not recognized as a receivable and consequently does not contribute to income. Only when expenses are incurred under the grant is an account receivable created and income recorded. This treatment matches revenues and expenses in accordance with the level of activities carried out under the grant.

This accounting policy permits CIMMYT to distinguish between income and amounts pledged in core restricted and extra core grants. This is necessary since these grants often cover more than one year's activities or contain carry-forward provisions in cases of underexpenditure. Recognizing the total pledge in a given year as income could result in an overstatement of income. Core unrestricted grants do not require this treatment since they are given annually and the amount pledged represents income that year.

### **Note 3 — Mexican Peso Transactions.**

At December 31, 1984 CIMMYT had Mexican peso assets and liabilities amounting to Ps 147,605,000 (Ps 328,609,000 in 1983) and Ps 117,044,000 (Ps 58,898,000 in 1983), which were included in the statement of condition at their U.S. dollar equivalents resulting from applying the year-end rate of Ps 209.22 per dollar.

In 1984 the value of the Mexican peso compared to the dollar fell from Ps 160.47 to Ps 209.22 to the dollar (Ps 147.90 to Ps 160.47 in 1983). This devaluation gave rise to a translation loss aggregating U.S. \$ 303,000 (U.S. \$ 108,000 in 1983). In accordance with FAS 52, where the firm is judged to be operating in a hyper-inflationary environment and the dollar is judged to be the functional currency, the translation effect in each year is charged to current income.

The foreign exchange system existing in Mexico permits the parallel existence of a controlled market and a free market.

At February 8, 1985 date of issuance of the Financial Statements, the exchange rates with the U.S. dollar were as follows:

	Buy Pesos/U.S. Dollar	Sell Pesos/U.S. Dollar
Controlled	Ps 199.09	Ps 199.29
Free	Ps 215.85	Ps 217.35

and are currently subject to a slippage of Ps 0.17 a day.

#### Note 4 — Operating funds.

The CGIAR permits CIMMYT (and all other international agricultural research centers funded through it) to maintain, as part of the center's capital accounts, operating funds equal to thirty days of its core operating budget. In 1984 and 1983 there was no increase in operating funds given the small change in the dollar value of core operations.

#### Note 5 — Revenue and expenses:

A. Revenue. CIMMYT's revenues are grouped into six categories:

i) Grants. These are funds received from donors and are used to support two types of programs at CIMMYT: core and extra core. Core programs must fall within the mandate of the center and be approved by the Board of Trustees. These must also be approved by the members of the CGIAR, who then provide funding. The CGIAR membership includes governments, government aid agencies, international and regional development banks, and private philanthropic foundations (see Exhibit 2). Core programs are divided into two groups: unrestricted and restricted. Unrestricted grants come with only one requirement: that the funds be used to

support core activities. Restricted grants also support core activities but they must be used for an activity mutually agreed upon by CIMMYT and the donor.

Extra core programs must also fall within CIMMYT's mandate and also must be approved by the Board of Trustees. They fall outside of any direct funding through the CGIAR and may be considered related but distinct sets of activities from the core program. In general they are of four types: 1) direct assistance (i.e. posting of staff) to national programs; and 2) training at CIMMYT for persons from a specific country, and 3) collaborative research arrangements with other institutions; and 4) special exploratory research activities. Coordination of this type of funding is done between CIMMYT and the donor.

ii) Administrative Fees. These fees are charged on restricted and extra core grants. They permit CIMMYT to offset the cost of administering these grants, which by design only fund specific research activities. In 1984 and 1983 this fee was generally 15% though for some on-campus activities it was 25%.

iii) Sale of Crops. CIMMYT operates four experiment stations throughout Mexico. Grain and other produce not required for continuance of the research programs is sold from time to time depending on their availability and quality, and revenues received are registered as income of the period.

iv) Interest on Short-Term Investments. Surplus cash is invested in Short-Term interest bearing securities, and any interest earned is recorded as income. Similarly interest expense arising from short-term borrowings to cover cash deficit positions is charged to this account.

v) Auxiliary Services. These comprise revenues from the following areas within CIMMYT: Cafeteria, Laundry, Guest House, Dormitories and Staff Residences. As a whole, they are intended to be self-supporting.

vi) Other Income. This is a grouping of miscellaneous revenues received from the sale of surplus items such as used tires and other small pieces of equipment no longer needed by CIMMYT.

B. Expenses. The breakdown of CIMMYT's expenses as shown in its statement of activity is largely self-explanatory. Included under Research Programs, the largest single expenditure, are the expenses of the Maize, Wheat, Economics, Experiment Stations, Laboratories and Data Processing units. In 1984 and 1983 their expenses were as follows:

(000's)	1984	1983
Maize	5,664	4,439
Wheat	6,742	5,927
Economics	1,265	1,196
Experiment Stations	1,452	1,145
Laboratories	385	293
Data Processing	636	576
Others	357	2
Total	16,501	13,578

**Note G — Accounts receivable — and (Payments in Advance)**

Donors: In 1984 and 1983 these were comprised as follows:

Others: In 1984 and 1983 these were comprised as follows:

Accounts Receivable - Donors (000's)	1984	1983	(000's)	1984	1983
Canadian International Development Agency	92		Loans to Senior Staff	256	226
European Economic Community	169	49	Personal Charges to Employees	(82)	(39)
International Crops Research Institute for the Semi-Arid Tropics		20	Official Expenses Advances	218	29
International Center for Agricultural Research for Dryland Areas	10		Employee Credit Union	(52)	
Instituto Nacional de Investigación y Promoción Agropecuaria Peru/World Bank	27		Miscellaneous Debtors	89	115
OPEC Fund for International Development	138	155	Total	429	331
Philippines, Government of		58			
Spain, Government of		100	A program of loans to senior staff, mainly to provide partial financing for house purchases, was initiated in 1982. These carry an interest rate of prime plus 1.75%.		
The Ford Foundation	52				
United Nations Development Programme	457				
United States Agency for International Development	395	1,736			
World Bank	52				
Other Donors	45				
Sub Total: Accounts Receivable - Donors	1,437	2,118			
<b>Payments in Advance - Donors</b>					
Australia, Government of	(74)				
Canadian International Development Agency		(64)			
Germany, The Federal Republic of	(105)				
International Development Research Centre	(136)				
Instituto Nacional de Investigación y Promoción Agropecuaria Peru/World Bank		(22)			
International Crops Research Institute for Semi Arid Tropics	(11)				
Italy, Government of	(337)				
Japan, Government of	(283)				
Norwegian Agency for International Development	(31)				
Switzerland, Government of	(455)	(1,090)			
The Ford Foundation		(31)			
The Netherlands, Government of	(96)				
United Nations Development Programme		(127)			
Other Donors	(21)	(87)			
Sub Total: Payments in Advance - Donors	(1,549)	(1,421)			
Net Status of Donors Payments	(112)	697			

## Detailed Statement of Activity

For the Period January 1 to December 31, 1984

### Exhibit 1

Currency: U.S. Dlls. (000's)

	Core Unrestricted	Core Restricted	Extra Core & Cooperative	Auxiliary Services	Total
<b>Revenue (Note 5)</b>					
Grants	14,939	4,889	3,877		23,705
Administrative Fees	1,096				1,096
Sale of Crops	22				22
Interest on Short-Term Investments	508				508
Auxiliary Services				629	629
Other Income	2				2
<b>Total Revenue</b>	<b>16,567</b>	<b>4,889</b>	<b>3,877</b>	<b>629</b>	<b>25,962</b>
<b>Expenses (Note 5)</b>					
Research Programs	10,576	3,252	2,673		16,501
Conferences and Training	1,737	984	761		3,482
Information Services	789				789
General Administration	1,504				1,504
Plant Operations	1,475				1,475
Capital Acquisitions	432			175	607
Auxiliary Services				637	637
Indirect Costs		653	443		1,096
Seniority Premiums	50				50
<b>Total Expenses</b>	<b>16,563</b>	<b>4,889</b>	<b>3,877</b>	<b>812</b>	<b>26,141</b>
Excess (Deficit) of Revenue over Expenses before translation effect	4	—	—	(183)	(179)
Translation Effect for the year	(303)				(303)
Net (Deficit) of revenue over expenses	(299)	—	—	(183)	(482)

## Detail of Sources of Income from Grants

For the Period January 1 to December 31, 1984

### Exhibit 2

Currency: U.S. Dlls. (000's)

	Unrestricted	Restricted	Extra Core & Cooperative	Total
Australia, Government of	481			481
Brazil, Government of	150			150
Canadian International Development Agency	1,198		1,499	2,697
China, People's Republic of	50			50
Denmark, Government of	296			296
European Economic Community		521		521
France, Government of		88		88
Germany, The Federal Republic of	634	84	33	751
Inter - American Development Bank	3,563			3,563
International Board for Plant Genetic Resources			80	80
International Center for Agricultural Research for Dryland Areas			10	10
International Crops Research Institute for The Semi-Arid Tropics			270	270
International Development Research Centre		67	19	86
Instituto Nacional de Investigacion y Promoción Agropecuaria Peru/World Bank			134	134
India, Government of	41			41
Ireland, Government of		65		65
Japan, Government of		935	14	949
Mexico, Government of			215	215
OPEC Fund for International Development		160		160
Philippines, Government of	13			13
Spain, Government of	200			200
Switzerland, Government of Norwegian Agency for International Development	131	27	111	1,014
The Ford Foundation	100	73	60	233
The Netherlands, Government of		171		171
The Rockefeller Foundation		100		100
The United Kingdom	541			541
United Nations Development Programme		1,695	250	1,945
United States Agency for International Development	6,000		961	6,961
World Bank	1,541			1,541
Miscellaneous Training and Research Grants			221	221
<b>Total Income from Grants</b>	<b>14,939</b>	<b>4,889</b>	<b>3,877</b>	<b>23,705</b>

## Core-Restricted Pledges and Expenses

For the Period January 1 to December 31, 1984

### Exhibit 3

Currency: U.S. Dlls. (000's)

	Grant Period (1) (mo/day/yr)	Grant Pledged (1)	Prior Years	Expenses This Year	Total
<b>Government of France</b>					
Collaborative Research-Maize	01/01/84 – 12/31/84			51	51
Bread Wheat	01/01/84 – 12/31/84			20	20
Triticale	01/01/84 – 12/31/84			17	17
<b>Total</b>		<b>88 (2)</b>	<b>N/A</b>	<b>88</b>	<b>88</b>
<b>Government of Japan</b>					
Wheat Disease Surveillance	01/01/84 – 12/31/84			144	144
Wheat and Maize Plant Protection	01/01/84 – 12/31/84			368	368
Wheat Southern Cone	01/01/84 – 12/31/84			423	423
<b>Total</b>		<b>935 (3)</b>	<b>N/A</b>	<b>935</b>	<b>935</b>
<b>OPEC Fund for International Development</b>					
Maize West Africa Phase I	01/01/83 – 03/31/84	375	325	50	375
Maize West Africa Phase II	07/01/84 – 12/31/85	225	N/A	110	110
<b>Total</b>		<b>600</b>	<b>325</b>	<b>160</b>	<b>485</b>
<b>Government of Switzerland</b>					
Central America & Caribbean-Maize	01/01/82 – 12/31/84		727	644	1,371
Central America and Caribbean-Economics	01/01/82 – 12/31/84		292	259	551
<b>Total</b>		<b>2,015</b>	<b>1,019</b>	<b>903</b>	<b>1,922</b>
<b>Government of the Netherlands</b>					
Wheat and Maize Training	01/01/84 – 12/31/84	94	N/A	94	94
Computer Programmer	01/06/83 – 05/31/84		40	77	117
<b>Total</b>		<b>94 (4)</b>	<b>40</b>	<b>171</b>	<b>211</b>
<b>United Nations Development Programme</b>					
Nutritional Quality Maize Phase IV	04/01/79 – 03/31/84	7,088	5,925	1,161	7,086
Tropical Wheat	07/01/82 – 06/30/87	2,415	397	534	931
<b>Total</b>		<b>9,503</b>	<b>6,322</b>	<b>1,695</b>	<b>8,017</b>

(1) For Information purposes only

(2) Equivalent to FF 800,000

(3) Equivalent to Yen 228,000,000

(4) Equivalent to Dfl 300,000

(5) Equivalent to ECU 2'000,000

(6) Equivalent to IR £ 55,000

(7) Equivalent NOK 450,000

(8) Equivalent CA 182,000

N/A = Not applicable

**Exhibit 3 (Cont'd)**

Currency: U.S. Dls. (000's)

	Grant Period (1) (mo/day/yr)	Grant Pledged (1)	Expenses		
			Prior Years	This Year	Total
<b>European Economic Community</b>					
Andean Regional Wheat and Maize	03/12/83—03/12/86	1,955	547	521	1,068
<b>Total</b>		1,955 (5)	547	521	1,068
<b>Government of Ireland</b>					
Training Wheat	01/01/84—12/31/84	65		65	65
<b>Total</b>		65 (6)	N/A	65	65
<b>The Rockefeller Foundation</b>					
Training Wheat and Maize	01/01/84—12/31/84	100		100	100
<b>Total</b>		100	N/A	100	100
<b>Norwegian Agency for International Development</b>					
Training Wheat and Maize	01/01/84—12/31/84	58		27	27
<b>Total</b>		58 (7)	N/A	27	27
<b>The Ford Foundation</b>					
East Africa	09/24/81—03/31/84	256	102	73	175
<b>Total</b>		256	102	73	175
<b>Government of Federal Republic of Germany</b>					
Wheat Improvement Program	07/01/83—06/30/85	291	29	84	113
<b>Total</b>		291	29	84	113
<b>International Development Research Centre</b>					
Data Processing	11/15/82—11/30/84	140	89	67	156
<b>Total</b>		140 (8)	89	67	156
<b>Total Core-Restricted</b>			<b>8,473</b>	<b>4,889</b>	<b>13,362</b>

- (1) For information purposes only  
(2) Equivalent to FF 800,000  
(3) Equivalent to Yen 228,000,000  
(4) Equivalent to Dfl 300,000  
(5) Equivalent to ECU 2'000,000  
(6) Equivalent to IR £ 55,000  
(7) Equivalent NOK 450,000  
(8) Equivalent CA 182,000  
N/A = Not applicable

## Extra Core Pledges and Expenses

For the Period January 1 to December 31, 1984

### Exhibit 4

Currency: U.S. Dlls. (000's)

	Grant Period (1) (mo/day/yr)	Grant Pledged (1)	Prior Years	Expenses This Year	Total
<b>The Ford Foundation</b>					
Economics and Training Algeria	09/01/79 – 08/31/85	680	574	60	634
<b>Total</b>		<b>680</b>	<b>574</b>	<b>60</b>	<b>634</b>
<b>United States Agency for International Development</b>					
Pakistan/Agricultural Research Council					
Wheat and Maize	04/01/76 – 09/31/84	3,212	2,408	322	2,730
Wheat and Maize	10/01/84 – 12/31/88	5,208 (3)	–	175	175
Miscellaneous Training	(2)	N/A	N/A	78	78
Africa On-Farm Research	06/01/82 – 03/31/85	1,213	301	386	687
<b>Total</b>		<b>9,633</b>	<b>2,709</b>	<b>961</b>	<b>3,670</b>
<b>United Nations Development Programme</b>					
Barley Yellow Dwarf Virus	01/01/84 – 01/31/85	78	N/A	78	78
Biotechnology Consortium	09/10/84 – 09/09/85	40	N/A	10	10
T.C.D.C. Training	(2)	N/A	N/A	30	30
Turkey Wheat	12/31/83 – 12/20/85	263	–	132	132
<b>Total</b>		<b>381</b>	<b>–</b>	<b>250</b>	<b>250</b>
<b>Canadian International Development Agency</b>					
Triticale Research and Training	04/01/78 – 12/31/80	286 (4)	246	24	270
Haiti-Economics	01/01/83 – 12/31/84	200 (5)	93	105	198
East Africa Cereal Program	10/01/84 – 02/31/88	2,118 (6)	–	47	47
Ghana Maize Phase II	10/01/83 – 09/30/88	3,803 (7)	37	822	859
Bangladesh-Wheat	04/01/82 – 04/30/87	3,744 (8)	735	464	1,199
Associate Scientist Data Processing	04/19/82 – 03/31/84	80	68	12	80
Miscellaneous Training	(2)	N/A	N/A	25	25
<b>Total</b>		<b>10,231</b>	<b>1,179</b>	<b>1,499</b>	<b>2,678</b>

(1) For information purposes only

(2) Grant period not applicable donor pays tuition for each trainee sponsored

(3) Equivalent to Rp 33'143,075 U.S. 2'286,000 plus U.S. 2'922,000

(4) Equivalent to CA 338,944

(5) Equivalent to CA 245,000

(6) Equivalent to CA 2'753,000

(7) Equivalent to CA 4'754,300

(8) Equivalent to CA 4'680,000

(9) Equivalent to CA 65,888

(10) Equivalent to CA 387,075

(11) Equivalent to CA 196,750

N/A = Not applicable

(–) Indicates zero or insignificant amount

**Exhibit 4 (Cont'd)**

Currency: U.S. Dlls. (000's)

	Grant Period (1) (mo/day/yr)	Grant Pledged (1)	Prior Years	Expenses This Year	Total
<b>Government of Switzerland</b>					
Central America and Caribbean Seed Production	07/01/83 – 06/30/86	1,050	37	111	148
<b>Instituto Nacional de Investigación y Promoción Agropecuaria Peru/World Bank</b>					
Wheat	08/01/83 – 07/31/85	190	54	134	188
<b>Government of Federal Republic of Germany</b>					
Maize Improvement Program	01/01/83 – 12/31/84	128	26	33	59
<b>World Bank – CGIAR Secretariat</b>					
Financial Management & Budget Study	01/01/84 – 12/31/85	N/A	N/A	120	120
<b>Government of Mexico</b>					
Research	01/01/84 – 12/31/84	N/A	N/A	215	215
<b>Government of Japan</b>					
Training Building	11/01/84 – 12/31/85	600	N/A	14	14
<b>International Development Research Centre</b>					
Bibliographic Service on Wheat & Small Grains	01/01/84 – 12/31/86	53 (9)	N/A	3	3
Information Service on Wheat & Small Grains	06/29/84 – 06/30/87	295 (10)	N/A	11	11
Data Base Management	11/02/84 – 11/02/86	160 (11)	N/A	5	5
<b>Total</b>		<b>508</b>		<b>19</b>	<b>19</b>
<b>International Board for Plant Genetic Resources</b>					
Maize Germplasm Bank	01/01/84 – 12/31/84	80	N/A	80	80
<b>Miscellaneous Training Grants</b>					
	(2)	N/A	N/A	101	101
<b>Cooperative Projects</b>					
ICARDA – Barley Project		–	N/A	10	10
ICRISAT – Sorghum Project	01/01/81 – 12/31/84	817	401	270	671
<b>Total</b>		<b>817</b>	<b>401</b>	<b>280</b>	<b>681</b>
<b>Total Extra Core</b>		<b>N/A</b>	<b>4,980</b>	<b>3,877</b>	<b>8,857</b>

(1) For information purposes only

(2) Grant period not applicable donor pays tuition for each trainee sponsored

(3) Equivalent to Rp 33'143,075 U.S. 2'286,000 plus U.S. 2'922,000

(4) Equivalent to CA 338,944

(5) Equivalent to CA 250,000

(6) Equivalent to CA 2'753,000

(7) Equivalent to CA 4'754,300

(8) Equivalent to CA 4'680,000

(9) Equivalent to CA 65,888

(10) Equivalent to CA 387,075

(11) Equivalent to CA 196,750

N/A = Not applicable

(–) Indicates zero or insignificant amount

## Extra-Core Grants

Extra-core programs are generally of four types:

- 1) Direct assistance (posting of staff or provision of research equipment) to national or regional programs,
- 2) Specialized or advanced-degree training,
- 3) Collaborative research arrangements of a more basic or longer-term nature, and
- 4) Special exploratory research activities.

The CIMMYT Board of Trustees has established certain guidelines with respect to extra-core grants:

- 1) The objective must be within the mandate of CIMMYT,
- 2) The action should not be a mere technical assistance contribution to a country or region but have some potential to strengthen CIMMYT's overall research competence,

- 3) It should, in appropriate cases, have a training component, either for CIMMYT staff through the gaining of experience or in enhancing national capacity in the area of concern,
- 4) It should not pose an administrative burden on CIMMYT which is not fully identified and reimbursed by overhead or other means in the funding of the project, and
- 5) It should not imply a continuing obligation for CIMMYT, e.g., all potential staff repatriation, rehabilitation or ancillary costs on termination must be funded by the donor.

In 1984, extra-core grants amounted to \$3,877,000 or 16 percent of total expenditures. Reports on nine major grants are included in the following pages. Several other major grants began late in the year and will not be reported until 1985.

# Maize

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**Project:** Central America and Caribbean Maize Seed Production

**Donor:** Swiss Development Cooperation

**Pledge:** US\$ 1,050,000

**Duration:** July 1983 - June 1986

## Financial Summary

Expenses (US \$)

Previous Years	\$ 37,000
1984	\$ 111,000
Total to Date	\$ 148,000

Balance Available \$ 902,000

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## Objectives

The primary objective of the project, involving cooperation between CIMMYT and the 13 governments of the Central American and Caribbean region, is to improve the maize seed production activities in order to make more effective and efficient use of the germplasm and technology now being generated through a companion project for maize improvement, also funded by the Swiss Development Corporation as part of CIMMYT's core program.

## Staffing

One CIMMYT staff member is assigned full time to the project. He is based in Mexico and travels extensively throughout the region.

## Project Description

The seed production specialist is involved in five major areas.

- 1) Liaison with national seed production agencies,
- 2) Developing mechanisms to forecast seed demand and to generate supplies of superior varieties as they are generated by the maize improvement program,
- 3) Working with breeders to develop expertise in the final step of variety development and description through a) selection of individual plants from an experimental variety that will be used for initial seed for increase of variety released, and b) varietal description for producer utilization and certification (stressing unique traits),
- 4) Training individuals in a) breeder seed maintenance and production of basic seed and b) production of foundation and certified seed, and
- 5) Assistance in procuring equipment, and sponsorship for workshops in the region.

## Activities in 1984

Activities this year focused on creating variety descriptions, forecasting demand for each seed category, developing realistic pricing schedules, arranging national staff visits to CIMMYT, and sponsoring national staff attendance in a variety of conferences and workshops. Maintenance of 11 open-pollinated maize varieties, principally grown in 7 Central American and Caribbean countries, received priority attention during the year.

CIMMYT staff participated in 14 in-country training sessions on seed production and open-pollinated varieties in Panama, Costa Rica, Honduras, Guatemala and Haiti. Plans are now being made for the 1985 courses in agronomy and maize seed production.

Equipment originally purchased in 1982-83 for improving maize seed quality is now being installed in Haiti, Costa Rica, Dominican Republic, Panama, Guatemala and Honduras. Full operation should be under way in all countries in 1985.

# Maize

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<b>Project:</b>	<b>Ghana Maize Program, Phase II</b>
<b>Donor:</b>	Canadian International Development Agency (CIDA)
<b>Pledge:</b>	CA\$ 4,754,300 US\$ 3,803,000 (est.)
<b>Duration:</b>	October 1983 - September 1988

## Financial Summary

Expenses (US \$)	
Previous Years	\$ 37,000
1984	\$ 822,000
Total to Date	\$ 859,000
Balance Available	\$ 2,944,000

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## Objectives

The project is Phase II of an ongoing effort that was initiated in 1979. The overall objective of the project is to increase maize production in Ghana by developing superior maize production technology and strengthening staff resources involved in the current maize research program conducted by the Crops Research Institute. Project staff also conduct research on cowpeas, in coordination with the International Institute of Tropical Agriculture (IITA). CIMMYT has agreed to staff the Grains Development Project for the first three years and to subcontract the cowpea research component to IITA.

## Staffing

The project has one joint coordinator and one agronomist resident in Ghana for the three-year grant period. IITA provides 2.5 man-years of scientific expertise to work on legumes. The economics component is carried out by two Ghanaian economists under the direction of project staff and with assistance from CIMMYT economists.

## Project Description

Three major activities are carried out under the grant:

- 1) Breeding which seeks to develop high-yielding varieties adapted to the various ecological zones and crops uses in Ghana. This is accomplished by selecting for:
  - a) increased grain yield and yield stability,
  - b) improved resistance to lodging,
  - c) improved disease and insect resistance,
  - d) development of specific maize varieties for various ecological zones, and for both growing seasons, and
  - e) development of improved protein quality maize for food and feed.
- 2) On-farm research and demonstrations that are complementary to the breeding program, to develop:
  - a) suitable agronomic practices for the various ecological zones of Ghana,
  - b) cropping systems that will include maize,
  - c) appropriate technology to aid the small scale farmer, and
  - d) extension information.

- 3) Economics research involving informal and formal survey techniques as well as information obtained from on-farm trials and demonstration sites to determine:
  - a) the place and importance of maize and cowpeas in existing farm activities,
  - b) farmer circumstances that influence acceptance of new technology and the identification of recommendation domains,
  - c) the probable socio-economic returns to farmers from recommended technologies as compared with traditional technologies, and
  - d) policy-related studies on the structure of the public agricultural sector and trade-related issues.

Substantial training is also provided under the grant at the graduate level (through Canadian and other foreign universities) and technical training offered at CIMMYT's headquarters in Mexico. Funds are also available for equipment purchases and maintenance necessary for the research and extension programs.

As part of a national production program, the grant has a wide range of beneficiaries, including farmers, consumers and the Crops Research Institute itself. The program also has a tie-in with CIMMYT's core research on maize and maintains close ties with the West Africa regional maize program.

### **Activities in 1984**

Germplasm development work continued on five gene pools that have been constituted from the best available materials to correspond to the major varietal types needed in Ghana. During 1984, streak-resistant materials were added to improve each pool for resistance to this important disease problem. Three international trials were also received from CIMMYT and were successfully conducted at two locations.

During 1984, the Crops Research Institute released four new open-pollinated varieties for commercial use (Dobidi CRI, Aburotia CRI, Dorke CRI, and Kawansei CRI) which draw on CIMMYT germplasm.

A program of crop management trials conducted on and off experimental stations was maintained during the year. On-station trials focused on planting dates, maize/cowpea rotations, and maize/cassava intercropping studies. In the on-farm trials program, 151 agronomic research trials and 435 verification/demonstration trials were conducted during the major season by the staff of the Grains and Legumes Development Board (GLDB) and the Ministry of Agriculture. Eleven types of trials were planted, covering such research issues as varietal evaluations, tillage systems, planting density, intercropping and rotation patterns, and fertilization.

A technology adoption study was conducted in July 1984 in which Ashanti farmers who previously had verification/demonstration trials on their farms were interviewed. In those

instances where the technology was not accepted, reasons were sought and this information is being used to formulate future research directions.

Three Ghanaian scientists attended in-service maize training courses in Mexico during 1984. In addition, one senior scientist has received a 6-month visiting scientist fellowship to CIMMYT in Mexico where he is working with the maize training officers in order to gain more experience in teaching methods for use in establishing a national in-service training program.

Six Ghanaian scientists from the GLDB and CRI were enrolled in M.Sc. programs and one scientist in a Ph.D program outside Ghana during 1984. Several of these scientists are due to return home in late 1984 or early 1985. One GLDB staff member also completed in December 1984 his 16-month period as an unclassified undergraduate at Guelph University and another staff member started on the same course in September 1984.

Most of the research equipment provided under the grant was received during 1984. Continued shortage of fuel for project vehicles remains a serious problem, especially for the on-farm research program.

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## Maize

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<b>Project:</b>	<b>Pakistan Maize Program</b>
<b>Donor:</b>	United States Agency for International Development (USAID)
<b>Pledge:</b>	US\$ 811,000 RPS 6,268,288 US\$ 1,333,000 (est. total)
<b>Duration:</b>	April 1976-September 1984

### Financial Summary

Expenses (US \$)	
Previous Years	\$ 1,102,000
1984	\$ 173,000
Total to Date	\$ 1,275,000
Balance Available	\$ 58,000

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### Objectives

This is an on-going activity that was initiated in 1976 as part of a major effort by USAID/Pakistan to provide assistance to the Pakistan Agricultural Research Council (PARC) to strengthen their adaptive research capability at the National Agricultural Research Center (NARC) and their cooperative programs at provincial centers.

### Staffing

The project has one agronomist specializing in maize production and short-term consultants, as required, for up to three man-months in training, and special breeding and storage problems.

### Project Description

The maize specialist assists the staff at NARC and at provincial research centers, as well as appropriate extension personnel as desired by the PARC in their on-going maize programs. Major research emphasis in the project is given to:

- 1) Development of short-season varieties for rainfed areas of maize production through the introduction of new strains and breeding of commercial varieties,
- 2) Increasing the protein quality content of commercial varieties,
- 3) Identifying the cause of leaf blight and stalk rot, broadening maize research to include more pathology research, and
- 4) Expanding breeders, seed production programs; work closely with research and extension staff to test experimental varieties under farm conditions; and help arrange field days and on-farm testing to demonstrate new technology.

Training for the staff of PARC and NARC, both in Pakistan and at CIMMYT's headquarters in Mexico, is also included in the project.

Pakistani research and extension programs, and farmers, are the intended beneficiaries of this project. CIMMYT's core research program in maize also benefits from the work on leaf blight and stalk rot and on efforts to produce short-season varieties for rainfed areas.

### Activities in 1984

During the year, two early-maturing populations NARC Pool 10, an early yellow material, and Pool 20, an early intermediate-to-early white material were improved to meet the growing needs of local farmers for earlier maturing varieties with high yield potential and good resistance. Seventeen trials from CIMMYT's International Maize Testing Program were also received by Pakistani researchers for testing and evaluation.

In the area of on-farm research, farm-level surveys were conducted in the North West Frontier Province and Islamabad districts. These surveys are the first of a series evaluating farmer adoption of the currently recommended production technologies. Preliminary results showed (1) acute shortage of, and high demand for, improved seed, (2) strong demand for maize fodder in many regions, which is limiting adoption of technologies for maximization of grain production, and (3) widespread failure to adopt line sowing attributed to shortages of labor and planting equipment at the time required.

CIMMYT staff participated in a variety of training activities in Pakistan during the year. The annual travelling research seminar was again held, with participants visiting federal and provincial maize research projects located throughout the country. In-service training courses were offered in experimental research design and in weed control. One Pakistani researcher also participated in maize in-service training in Mexico during 1984.

# Wheat

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<b>Project:</b>	<b>Bangladesh Wheat Program</b>
<b>Donor:</b>	Canadian International Development Agency (CIDA)
<b>Pledge:</b>	CA\$ 4,681,000 US\$ 3,740,000 (est. total)
<b>Duration:</b>	April 1982-March 1987

## Financial Summary

Expenses (US \$)	
Previous Years	\$ 735,000
1984	\$ 464,000
Total to Date	\$ 1,199,000
Balance Available	\$ 2,545,000

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## Objectives

The overall objective of the project is to increase wheat production in Bangladesh by developing superior wheat varieties and improved production technology, and to help strengthen and support the research and production staff currently assigned to the wheat research program of the Bangladesh Agricultural Research Institute (BARI). Equipment to support the research and experimental activities of the BARI wheat program is also being provided.

## Staffing

The project calls for eight man-years of long-term technical advisors and 30 man-months of short-term consultants. One CIMMYT staff member residing in Bangladesh, a breeder/pathologist is designated the joint coordinator for the program. A second person, an agronomist, was assigned to the project in 1983.

## Project Description

The project includes three primary components:

- 1) Technical assistance. CIMMYT staff assigned to the project devote their time to wheat breeding and cropping systems research. Breeding work is oriented toward increased grain yields and yield stability, development of varieties for various ecological zones and improved disease and insect resistance. Cropping systems research includes fertilizer trials, soil testing, improved water and soils management and integrated pest management.
- 2) Training. Included in the project are 430 man-months of training: 192 man-months for Ph.D candidates, 108 man-months for MSc candidates, 120 man-months for in-service trainees at CIMMYT, and 10 man-months for visiting scientists, also at CIMMYT.
- 3) Equipment. Some US\$ 500,000 are set aside in the project for the purchase of field and laboratory equipment appropriate for use by the BARI wheat program.

The project is designed to help provide training and other educational opportunities and equipment to the BARI wheat staff and to help continue the flow of appropriate wheat varieties and technology to farmers in Bangladesh. The project also has a direct relationship with core program wheat research efforts aimed at developing early-maturing varieties with tolerance to heat stress and improved resistance to *Helminthosporium* leaf spots.

## Activities in 1984

With four varietal releases in 1983 no new varieties were released in 1984. However, one advanced line performed well in 1984 under replicated yield tests and will probably be released in 1985 for commercial production. The system to develop "flexible date" varieties, i.e., ones capable of producing acceptable yields under late-planted conditions but yield responsive if planted at a more favorable date, has resulted in the elimination of undesirable lines that do not meet this important breeding criterion. As a consequence, the number of lines included in the most advanced replicated yield trials has been reduced.

Twenty-seven international nurseries from CIMMYT were sent to Bangladesh in 1983-84 consisting of 21 bread wheat, 1 durum wheat, 2 triticale, 1 barley, and 2 special germplasm development nurseries.

In the area of pathology research, the 1983/84 nurseries grown at Joydebpur were successfully inoculated with leaf rust derived from naturally occurring populations collected and preserved in the previous season. With the initiation of artificially induced epidemics, it was found that 50 percent of the entries in the advanced trial were susceptible and had to be eliminated. With the probability of "escapes" curtailed, the program will now make more rapid progress in the development of varieties with resistance to leaf rust.

Increased emphasis was given in 1984 to the identification of lines resistant to *Helminthosporium sativum*. Reasonable levels of resistance were observed in lines from several nurseries. Apparently resistant materials from the CIMMYT

## Bangladesh (cont'd.)

Helminthosporium nursery were crossed to materials adapted to the Bangladeshi environment. Progress is being made in incorporating this resistance into materials with a suitable agronomic background.

The soil-borne pathogen, *Sclerotium rolfsii*, which reduces plant stand, has become a potentially serious problem (for the 1984/85 season) apparently due, in part, to warmer than usual temperatures during November and December. Studies are planned to determine any possible preventative methods, although this pathogen is notoriously difficult to control.

A second CIMMYT staff member joined the project in 1983 with responsibilities in agronomy, arriving in time to initiate a program of on-station and on-farm trials in 1983/84. On-station trials were conducted on dates of planting and tillage systems. Results confirmed the competitiveness of the new Bangladeshi varieties with the predominant commercial variety, Sonalika, under late sown conditions, and their yield

advantage over this popular variety when sown early. The tillage experiments revealed that there is no yield difference between traditional tillage and minimum tillage systems; however, substantial savings in labor and traction power are realized with the minimum tillage system.

On-farm trials were conducted to determine the residual effects of nitrogen (N), phosphorus (P), potassium (K), and sulfur (S) fertilizers applied on wheat for the succeeding crop of early-maturing rice (aus). While these experiments continue through mid 1985, data generated to date show that without applications of N, P, K, and S, wheat yields are reduced by 47, 16, 11, and 5 percent, respectively. These data pointedly demonstrate the continuous and general need for N and P fertilizers, particularly nitrogen, and the increasing requirements for potassium and sulfur.

During 1984, four BARI scientists attended in-service training courses in CIMMYT wheat improvement and wheat production and two senior scientists came to Mexico as visiting scientists to observe the Maize and Wheat Improvement Programs. One BARI scientist also attended CIMMYT's Tropical Wheat Seminar held in September in Mexico City.

Four of the seven scholarships for M.Sc. and Ph.D degrees provided by the project were in use in 1984. Two BARI scientists are pursuing Ph.D degrees in plant breeding and agronomy, and two are pursuing M.Sc.

degrees in plant breeding and plant pathology. Two candidates have been identified to begin Project-sponsored Ph.D degrees in 1985. Problems still exist in obtaining clearances for some candidates to study abroad.

Project research and field equipment have been cleared with few difficulties. During 1984, four self-propelled plot seeders and four research combines and four stationary plot threshers arrived in time to be tested and put to use in the 1983/84 season. The combines and stationary threshers performed up to expectations; three of the stationary threshers were distributed to regional stations in 1984 and two of the combines will probably be distributed for use in 1985. A 45-hp tractor arrived in 1984 and was used to good advantage in the 1984/85 season for land preparation. Laboratory equipment was also received in 1984 and renovation of existing laboratory facilities and construction of additional seed storage facilities are nearly completed.

During 1984, the project also financed the purchase of a multi-purpose building and the construction of a garage facility at BARI, Joydebpur. The building will provide additional office, laboratory, seed preparation and cold storage space for the BARI Wheat Center. These facilities will be fully operational in 1985.

# Wheat

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<b>Project:</b>	<b>Pakistan Wheat Program</b>
<b>Donor:</b>	United States Agency for International Development (USAID)
<b>Pledge:</b>	US\$ 810,000 RPS. 5,644,887 US\$ 1,374,000
<b>Duration:</b>	April 1976 - September 1984

## Financial Summary

Expenses (US \$)	
Previous Years	\$ 1,049,000
1984	\$ 150,000
Total to Date	\$ 1,199,000

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Balance Available	\$ 175,000
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## Objectives

This is an on-going activity that was initiated in 1976 as part of a major effort by USAID/Pakistan to provide assistance to the Pakistan Agricultural Research Council (PARC) to strengthen the National Agricultural Research Center (NARC) and cooperative programs at provincial centers.

## Staffing

The project calls for one agronomist specializing in wheat production and short-term consultants, as required, for up to three man-months in training and for special breeding and storage problems.

## Project Description

The wheat specialist is involved in four major areas of research and development:

- 1) Assistance to on-going research programs at NARC and provincial research centers with the aim of strengthening their crop improvement research programs,
- 2) Collaboration with NARC in initiating a soil tillage/moisture conservation research program to develop improved technology for rainfed crop production,

- 3) Cooperation in the promotion of a comprehensive weed control program at NARC, and
- 4) Assistance in staff development through training programs, both in-country and at CIMMYT headquarters in Mexico.

Like many other extra-core grants, this project is designed with an institution building component (PARC, NARC) and with a direct farmer linkage through the development of improved varieties and the identification of more productive agronomic practices. The research work done under the project also has feedback to CIMMYT's core programs, especially with research related to rainfed production technology.

## Activities in 1984

Estimates of 1984 wheat production in Pakistan vary from 10.5 to 11.5 M tons, lower than the 1983 record wheat crop of 13.32 M tons. Production in 1984 was affected by less than normal rainfall during the growing season and high temperatures during the grain-filling period.

During the year, agronomy research received the most attention from the project staff. Major emphasis was given to on-farm agronomic research in three geographic areas: Barani wheat areas of Rawalpindi and Islamabad Districts, rice-wheat areas of the Punjab, and maize-wheat areas of the Mardan District. Thirty-seven research sites have been planted in these areas.

In the Barani wheat areas, 17 on-farm research sites were chosen for placement of trials. The major research issues were tillage practices, variety, and fertilizer. Deep tillage with a moldboard plow gave more than 60 percent increase in yield compared to normal plowing with a cultivator.

In the rice-wheat areas of the Punjab, experiments were continued on stand establishment, varieties, fertilizer, weed control, tillage practices, and ways to reduce the turnaround time between rice harvest and wheat seeding. A new wheat variety is needed to replace the rust-susceptible variety Yecora, which has been banned from sale but still is

grown on 60 percent of the area. A new direct seed drill was used extensively in the trials and worked very well even when no tillage was used or where land preparation was poor and the rice stubble was a problem. The drill offers a potential alternative for reducing the turnaround time in a rice-wheat rotation.

In the maize-wheat areas of the Mardan District, variety, fertilizer, crop establishment, and weeds are the major research topics. Eleven on-farm research sites were selected and planted to experiments. Sites were chosen to represent wheat after maize and sugarcane, the two major cropping patterns in the area. Planting wheat after sugarcane was a problem because of the large quantity of stubble and trash from the cane crop. The new seed drill performed well in such cases.

Seventy international nurseries were sent by CIMMYT to Pakistan in 1983-84, consisting of 37 bread wheat, 12 durum wheat, 9 triticale, 6 barley and 6 special germplasm development nurseries. These were distributed among the different provincial and national research stations within Pakistan.

Five Pakistani scientists attended in-service wheat training courses in Mexico during the year. Short in-country courses were given in the use of computers and of mechanized seeders. The annual travelling wheat seminar included 35 people. Wheat on experiment stations, farmers fields, extension demonstrations and seed farms were evaluated for yield, disease and agronomic factors.

A consultant was also hired for one month to collect data on the impact of previous CIMMYT training. He also helped to redraw the wheat crop regions of Pakistan based on more up-to-date cropping pattern data.

Agreement was reached between CIMMYT and PARC for a new 4-year project phase. A memorandum of understanding was signed on November 15, 1984, retroactive to October 1.

# Wheat

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<b>Project:</b>	<b>Peru National Cereals Program</b>
<b>Donor:</b>	INIPA/World Bank
<b>Pledge:</b>	US\$ 190,000
<b>Duration:</b>	August 1983-July 1985

## Financial Summary

Expenses (US\$)	
Previous Years	\$ 54,000
1984	\$ 134,000
 Total to Date	 \$ 188,000
 Balance Available	 \$ 2,000

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## Objectives

The project aims to enhance CIMMYT's involvement with the National Institute for Agricultural Research and Production (INIPA) in strengthening its cereals research program through:

- 1) Advising national cereals research coordinators in program planning and research implementation, including the development of research facilities and manpower, and
- 2) Assisting program leaders to develop a national in-service training program and to assist in the selection of candidates for advanced training outside Peru.

## Staffing

The project is staffed by one CIMMYT staff member resident in Peru who serves as joint coordinator of the national cereals program during the two-year grant period. (The project is under consideration for an extension in 1985.) CIMMYT staff assigned to the Andean regional wheat and maize programs also provide support to the national cereals program of Peru.

## Project Description

The CIMMYT staff member assigned to this program focuses his attention on small grains research. Activities focus on crop improvement research to develop higher yielding, more yield dependable small grains, on-farm research to develop more appropriate production recommendations, foundation seed multiplication, and training in research procedures.

## Activities in 1984

During 1983-84, fifteen replicated wheat, triticale and barley yield trials were conducted at 17 locations within Peru. In addition, CIMMYT's international nursery program provided national researchers with 26 bread wheat, 20 durum wheat, and 15 triticale nurseries which were primarily tested in the highland valleys around Cuzco. In addition, five barley nurseries were received from CIMMYT/ICARDA barley breeder based at CIMMYT and other regional nurseries were sent from the CIMMYT regional wheat program headquartered in Ecuador.

An active on-farm research program has been launched by the Peruvian national cereals staff, looking at research issues related to fertilization, weed control, variety, plant density and interactions between these factors. With information gathered during exploratory on-farm trials in 1983-84, a series of verification trials were planted in 1984-85 to evaluate two possible recommendations on fertilizer use and weed control.

Seed multiplication and maintenance of four Peruvian wheat varieties adapted to the Andean highlands and three varieties adapted to the lowland coastal areas were conducted during the year. In addition, seed multiplication of the most promising advanced lines within the national cereals program was carried out in order to have sufficient quantities for future on-farm testing.

Considerable training support was provided during the year. Five Peruvian scientists completed in-service wheat training courses at CIMMYT headquarters during 1984. In addition, an in-service training course in on-farm research methodologies was accomplished during 1983-84. The course followed a "call" system in which participants were convened at a key points to plan, plant, and evaluate on-farm trials. The success of this instructional format has led to an expanded program in 1984-85 of in-country training in on-farm research methodologies.

# Wheat

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<b>Project:</b>	<b>Wheat Improvement in Turkey</b>
<b>Donor:</b>	United Nations Development Programme (UNDP)
<b>Pledge:</b>	US\$ 263,000
<b>Duration:</b>	December 1983-December 1985

## Financial Summary

Expenses (US\$)	
Previous Years	
1984	\$ 132,000
Total to Date	\$ 132,000

Balance Available \$ 131,000

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## Objectives

The project seeks to strengthen small grains cereals research in Turkey. Specifically, the project aims to attain the following immediate objectives:

- 1) Establishment of a germplasm exchange and distribution system that will allow Turkey to benefit from improved germplasm with superior characteristics,
- 2) Development of improved varieties that are suitable for particular wheat-growing zones in Turkey,
- 3) Increased understanding of the role and control of small grain diseases in production, and
- 4) Initiation of a national in-service training program to ensure the long-term sustainability of the National Cereals Project.

## Staffing

The project is staffed by one wheat breeder/pathologist resident in Turkey for the two-year grant period.

## Project Description

The project aims to establish a program of germplasm and information exchange between Turkey, CIMMYT, Oregon State University (OSU) and other major wheat-producing countries. Turkey's wheat research personnel, with the assistance of CIMMYT, identify superior wheat materials. An important aspect of this exchange program is to exploit winter x spring crosses.

The project also aims to develop spring and winter habit wheats for the various priority zones in Turkey. The first of these environments is found along the southern coast. Greater production would be possible if varieties specifically adapted to the region were developed.

Another priority zone is that of the Southeast, an area that tends to be fairly dry and is devoted largely to the production of durum wheat. Large-scale irrigation projects are under way in this region and there is a need to develop adapted wheat varieties for irrigated production as well as improved durum varieties for rainfed conditions.

A third area that receives greater emphasis is eastern Turkey, where more suitable varieties and production practices could increase the profitability of wheat production substantially.

Better resistance to various diseases will be incorporated into improved varieties as follows: loose smut for the Anatolian plateau; stripe rust for winter bread wheats, stripe and stem rusts for durum wheats; septoria, stripe rust and loose smut for spring wheat areas.

Three visiting scientist training fellowships envisaged for three weeks each are offered to national winter cereals scientists to acquire additional knowledge in the organization and management of a cereals improvement program, and to learn about the CIMMYT breeding materials. Also, one trainee per year will attend CIMMYT's in-service training in Mexico.

## Activities in 1984

During the year, a considerable amount of winter and spring wheat germplasm was evaluated by the project staff. More than 3,000 varieties, advanced lines and segregating populations of bread and durum wheat were received from research institutions in 14 countries. Evaluation trials of this material were planted in September, 1984. In addition, 61 international nurseries were sent by CIMMYT to Turkish scientists in 1983-84 consisting of 35 bread wheat, 28 durum wheat, 11 triticale, 18 barley, and 4 special germplasm development nurseries.

Surveys were carried out during 1984 to assess the most important diseases and to collect isolates of prevalent pathogens. From these surveys it appears that rusts continue to be the most prevalent diseases in all wheat-growing areas, while *Septoria* leaf blight is also of importance in some spring wheat areas. Localized problems also exist, such as Soil Borne Mosaic Virus and common bunt (where farmers don't treat their seed).

Informal consultations were held with staff consisting of reviewing breeding materials and research methodologies. A 10-day travelling seminar was also conducted during June, with two national wheat research leaders, four CIMMYT wheat headquarters staff and one UNDP expert participating. The seminar had two purposes: to provide national researchers with additional information on new germplasm and research activities under way elsewhere and to familiarize the CIMMYT staff with the Turkish winter cereals conditions and to better understand the national program.

National institutes have been surveyed for their equipment needs which are mainly in the area of spare parts and specialized breeding and pathological equipment. Purchase orders were expedited by the end of the year.

## Economics

<b>Project:</b>	Haiti Economics Program
<b>Donor:</b>	Canadian International Development Agency (CIDA)
<b>Pledge:</b>	CA \$ 245,000 US \$ 199,675 (est.)
<b>Duration:</b>	January 1983 -December 1984

### Financial Summary

Expenses (US\$)	
Previous Years	\$ 93,000
1984	\$ 105,000
Total to Date	\$ 198,000

Balance Available \$ None

### Objectives

The primary objective of the project is to facilitate the development and diffusion of technologies appropriate to the biological and socio-economic circumstances of representative Haitian farmers growing maize through the training of Haitian researchers in CIMMYT's techniques for on-farm research.

### Staffing

One CIMMYT staff member is assigned to the project for the two-year duration. Additional staff input is provided at no cost to the project by the maize agronomist and economist working in the Central American and Caribbean regional program and by a seed production specialist. This latter program is classified as core restricted and is funded by the Swiss Development Corporation.

### Project Description

The components of the project include:

- 1) Informal surveys of farmer's circumstances,
- 2) On-farm trials and demonstrations of production technologies, and
- 3) Training of Haitian researchers in on-farm research techniques.

The project is an important adjunct to CIMMYT's core Economics Program. Haiti, with its low levels of income, labor-intensive farming, and underfunded research service, offers a demanding environment for testing CIMMYT's procedures in on-farm research; it provides a milieu for testing new insights on the relationship between technology generation and the social scientist. As designed, the project benefits the Haitian national program and local maize producers. On a much larger scale, the potential beneficiaries are other national programs by means of the development of more effective mechanisms for bringing together biological and social science research.

### Activities in 1984

As a result of project-supported research, two promising technological components (nitrogen fertilization and the variety, La Maquina 7827) were recommended to maize farmers in the Les Cayes Plain in early 1984. In this context, the project's "catalytic" effect has been evident in the MARNDR decision to produce and distribute La Maquina 7827. Considerable government support was given to seed production and distribution of this variety and private fertilizer dealers report marked increases in sales of urea (46% N) in the Les Cayes region.

In late 1984 the Les Cayes Project added new research problems to its agenda. Especially important is the research on tillage systems. Most important in this regard has been the experiments related to conservation tillage, a technology designed in the short run to reduce maize production costs and in the long run to increase yields through improved soil structure and to address one of Haiti's most critical ecological problems, the rapid depletion of soils resources through erosion. Several herbicides are being evaluated to determine which gives most effective weed control in the zero tillage situation.

Various training activities were carried out during 1984. In addition to ongoing in-country training of CRDA personnel in Les Cayes in the application of the research methodology, a seminar in the economic evaluation of agronomic data was held in early 1984 for 28 Haitian scientists. The Director of the Les Cayes experiment station also attended seminars in Guatemala and Mexico during the year. The MARNDR agronomist working most closely with the project left Haiti in September 1984 to pursue an M.Sc. degree in the USA. In collaboration with the Faculty of Agronomy in Haiti, five summer students were also attached to the project in 1984. These students received field and classroom instruction and participated in farmer interviews and on-farm experiments.

The physical facilities at the Les Cayes station is also being improved through the development of an effective seed processing and training facility. An existing building is being reconditioned and new seed treatment equipment (provided by CIMMYT with Swiss Development Cooperation funding) is being installed. This new seed processing facility will significantly increase the capacity of the national program to provide sufficient quantity of quality breeder seed for seed production programs.

An autonomous national capacity to generate appropriate technologies for target groups of farmers is in the process of being developed in Haiti. A MARNDR evaluation of the Les Cayes project was requested by the Secretary of State for Agriculture and Natural Resources in late 1983. After conducting a series of interviews with farmers in the area, the review team recommended that the research procedures used in this project be extended to other areas of the country and to include research on other crops. To achieve this goal, national program leaders have asked that in-country training in the methodology be intensified in an extension of the project.

## Economics

<b>Project:</b>	<b>On-Farm Research in Eastern and Southern Africa</b>
<b>Donor:</b>	United States Agency for International Development (USAID)
<b>Pledge:</b>	US\$ 1,213,000
<b>Duration:</b>	July 1982 - March 1985

### Financial Summary

Expenses (US\$)	
Previous Years	\$ 301,000
1984	\$ 386,000
Total to Date	\$ 687,000
<b>Balance Available</b>	<b>\$ 526,000</b>

### Objectives

The project seeks to provide the expertise in on-farm research required by a number of national agricultural research and extension institutions and USAID agricultural project management teams in eastern and southern Africa. The project concentrates on four major objectives, all relating to on-farm research:

- 1) Direct collaboration with national programs,
- 2) Training,
- 3) Network development, and
- 4) Institutionalizing the on-farm research concept.

### Staffing

Two CIMMYT economists are assigned to the project. One is based in Swaziland and is responsible for collaborating with USAID-sponsored teams in Lesotho, Botswana, Swaziland and Malawi. The second is based in Kenya and concentrates on training and collaborating with USAID programs in the northern part of this region. In addition, the CIMMYT regional economist for eastern and southern Africa provides staff input into the project.

### Project Description

Major activities include:

- 1) Training. The project has implemented a series of in-country training programs using a format introduced by the CIMMYT economics staff. Training is carried out through a series of "calls" in which research trainees convene at an on-farm research area at various stages in a crop cycle. This is a learning-by-doing process starting with farm-level surveys and culminating with on-farm research trials and technology demonstrations.
- 2) Direct Cooperation with National Programs. At the request of national programs and their USAID collaborators, the CIMMYT staff participate in adaptive on-farm research surveys to assess farmer circumstances, evaluate possible new technological components to enhance farmer productivity, and design and implement appropriate on-farm trials.
- 3) Regional Seminars and Publications. The aim is to facilitate discussion and exchange among the various programs so that the accumulated experience can be shared.
- 4) Development of Research Results and Framing Recommendations. This serves not only as the final step in the on-farm research process but also helps to integrate on-farm research into national research and extension programs. It is an important part of the institutionalization of on-farm research.

Benefits from this project in the form of added productivity of the agricultural sector in the countries involved. This increased productivity itself will be the result of more effective agricultural research. In providing this expertise in on-farm research the CIMMYT economics program also benefit from the knowledge acquired and seeks to transfer these lessons to other areas of the world.

### Activities in 1984

Activities during the year were designed to support USAID bilateral agricultural research programs, with a farming systems orientation, and the national programs with which they are associated. During 1984 project staff provided direct input to national research institutions in Kenya, Malawi, Sudan, Swaziland, Zambia, and Zimbabwe. in on-farm research as an aid to technology generation. Contacts were also re-established with research institutions in Uganda.

Five international workshops were held in 1984. Two regional training workshops were held at Harare in association with the Department of Land Management, University of Zimbabwe; one regional workshop was held in Eldoret, Kenya for senior research and extension administrators from English-speaking Africa; two technical workshops, one held in Malawi on issues in on-farm experimentation, and the other in Lusaka, Zambia on the role of rural sociologists in farming systems research. One national workshop was held in Mozambique at the invitation of the government there. In-country training took place in Kenya, Malawi, and Zambia.

A final evaluation of this project funding period was carried out by USAID in December 1984. The report was highly favorable of the project and recommended its continuation for another five years. If approved, Phase II of this project would increase staffing levels, adding one economist and one maize agronomist. The latter is especially important as it will reduce the drain imposed on Mexico-based agronomists and will increase the professional expertise in agronomy available to national programs.

Project staff stationed in the region gave nine papers during year. A quarterly newsletter was issued within the region to a mailing list of 500 addresses. The number of contributions to it has increased, an important initial evidence of the institutionalization of on-farm research in the region.

## Information Services

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<b>Project:</b>	<b>Information Service on Wheat and Other Small Grains</b>
<b>Donor:</b>	International Development Research Centre (IDRC) Canada
<b>Pledge:</b>	CA \$ 387,075 US\$ 295,000 (estimated)
<b>Duration:</b>	September 1984 - September 1987

### Financial Summary

Expenses (US \$)	
Previous Years	\$ -0-
1984	\$ 11,000
Total to Date	\$ 11,000
Balance Available	\$ 284,000

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### Objectives

The project seeks to establish an information and documentation services for the benefit of the community conducting research on wheat and other small grains in the developing world. This objective will be met through the following activities:

- 1) Establish a Scientific Information Unit (SIU) and integrate the CIMMYT library within it.
- 2) Improve CIMMYT's capacity to respond to scientific questions from developing country research workers.
- 3) Deliver bibliographic services (CAB, AGRIS) to up to 700 individuals and institutions in developing countries. (The provision of the AGRIS journal of wheat, triticale, and barley is already covered by IDRC project No. 3-P-83-0254, and began operation in January 1984).
- 4) Develop a document-delivery service controlled by the progressive implementation of a coupon scheme.
- 5) Develop a local data base on CIMMYT-generated and other relevant literature, and
- 6) Produce state-of-the-art reviews.

### Staffing

The project has three local-hire staff members in the newly formed Scientific Information Unit (SIU) in which CIMMYT's existing library staff will also be incorporated. Project funds will support two positions: a senior scientific information officer and a clerk/secretary. Other SIU positions are funded by CIMMYT.

### Project Description

CIMMYT provide free of charge two bibliographic services (CAB, AGRIS) on wheat and other small grains to up to 700 collaborating scientists and institutions in the developing world. More than 15,000 references will be cited annually in these two bibliographic journals.

CIMMYT also offer recipients a document delivery service for the complete articles listed in the two bibliographic journals. On a limited basis, these documents will be provided free of charge.

Increased access to on-line databases for literature searches is also to be provided to CIMMYT staff and key collaborators.

CIMMYT plans to become an AGRIS input center for its own publications. A local data base will also be developed to access unique CIMMYT-generated information as well as literature received from other research collaborators.

State-of-the-art reviews on key research topics will be prepared by visiting scientists wholly dedicated to this purpose. CIMMYT scientists will cooperate with the visiting scientists in the consolidation of available information, and the SIU will provide logistical support for these exercises.

Efforts will be made also to establish a distribution center (using microfiche technology) on a pilot basis at a regional program office to provide hard copies of selected articles included in scientific literature collections on file at the office.

### Activities in 1984

The project was initiated in September 1984, and hence most activities reported this year are of an organizational nature. SIU staff were recruited and all new staff plus those already working in the library attended in-house computer users' training courses. Several staff also attended a course in computer-based bibliographic information retrieval procedures offered by DIALOG. The senior scientific information officer travelled to Ottawa, Rome, Vienna, London and Washington to get acquainted with international databases and information units, and to discuss project implementation.

Six issues of the *Wheat, Triticale and Barley* journal published jointly with the Commonwealth Agricultural Bureaux (CAB) were sent to a mailing list of 550 individuals and libraries. A coupon scheme for offering limited document delivery services to CIMMYT's closest developing country research collaborators, free of charge, was developed and made ready for implementation beginning in 1985.

Closer ties were also established with Mexican agricultural libraries. New listings were prepared of CIMMYT's serial publications and library collections and made available to other agricultural librarians and CIMMYT's own staff.