

CIMMYT 1982

International Maize and Wheat Improvement Center

Annual Report



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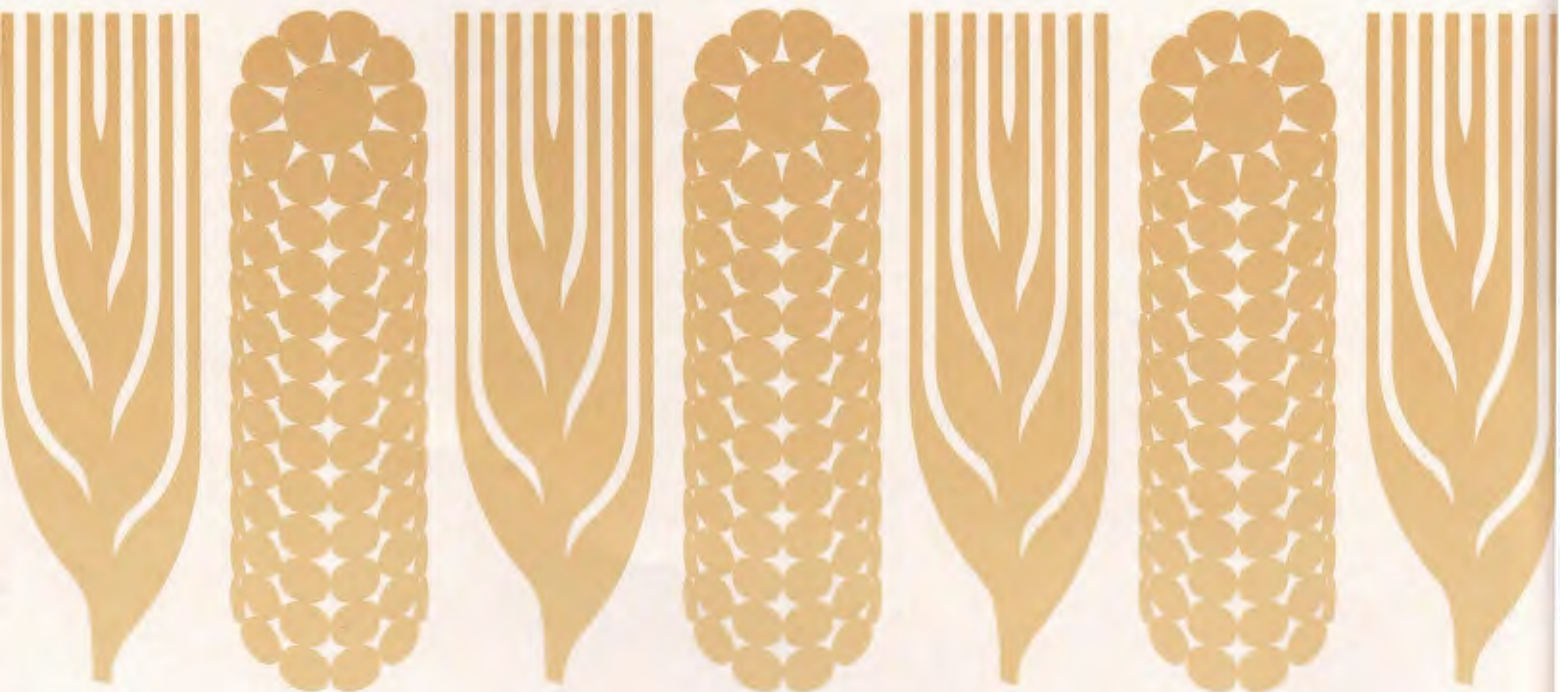
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Over 95 percent of CIMMYT's revenues are in the form of donations or grants from the above institutions. These grants are used to support two types of CIMMYT programs: core and extra core. Core programs must fall within the mandate of the Center and be approved by the CIMMYT Board of Trustees. These must also be approved by the Consultative Group on International Agricultural Research (CGIAR) whose members, including those governments and institutions listed above, provide the funding. 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 also must fall within CIMMYT's mandate and must be approved by the Board of Trustees. They fall outside of any direct funding through the CGIAR

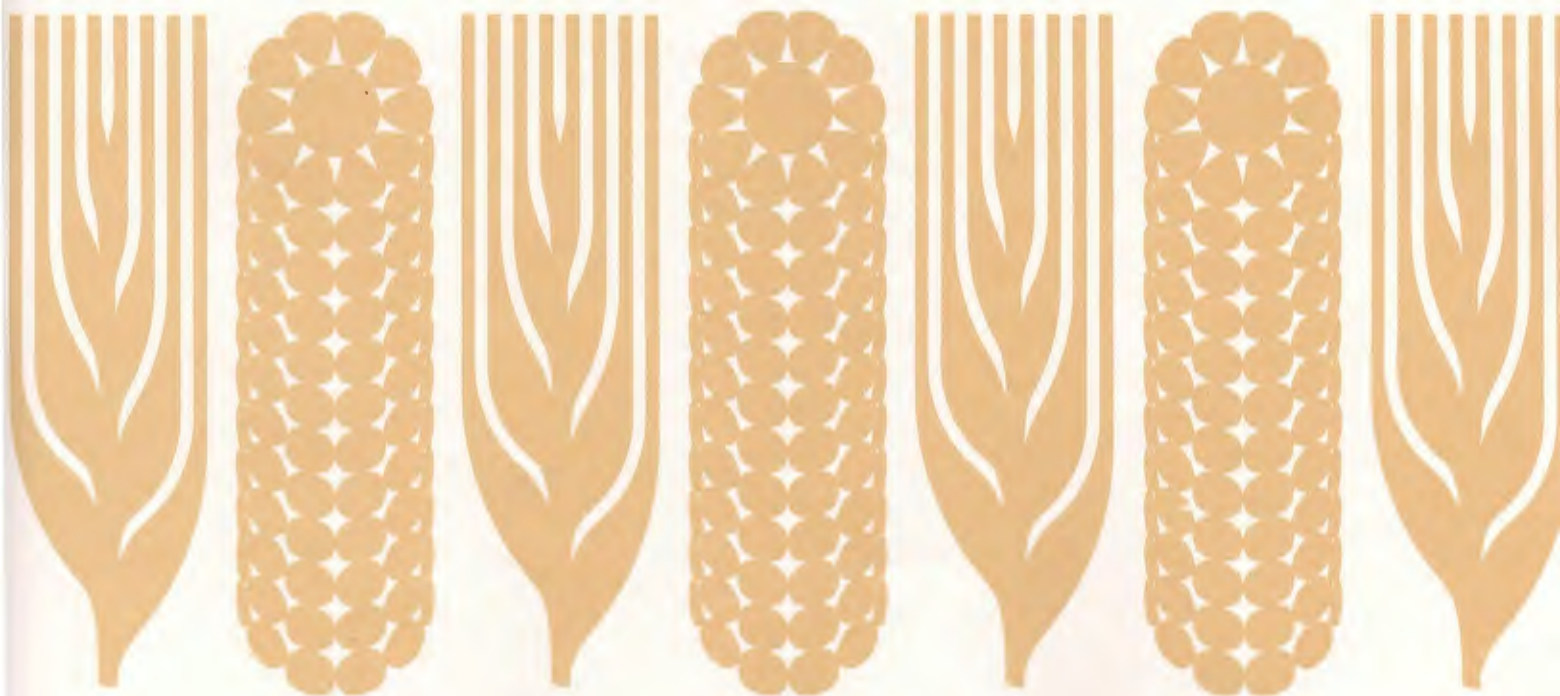
and may be considered related, but distinct, sets of activities from the core program. In general extra-core programs are of four types: 1) direct assistance, such as posting of staff or provision of research equipment to national programs, 2) specialized or advanced degree training, 3) collaborative research arrangements of a more basic or longer-term nature, and 4) special exploratory research activities. Coordination of this type of funding is done directly between CIMMYT and the individual donor.



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Disease Surveillance, Wheat Program

(Based in Turkey)

Introduction

It is a pleasure to report to you on CIMMYT's activities in 1982 in this new format. In this report you will find:

- A brief, nontechnical summary of CIMMYT's core program activities during 1982.
- The independently audited financial statement for the year.
- A five-year financial trend analysis and management discussion.
- A summary of activities carried out under specific extra-core grants during 1982.

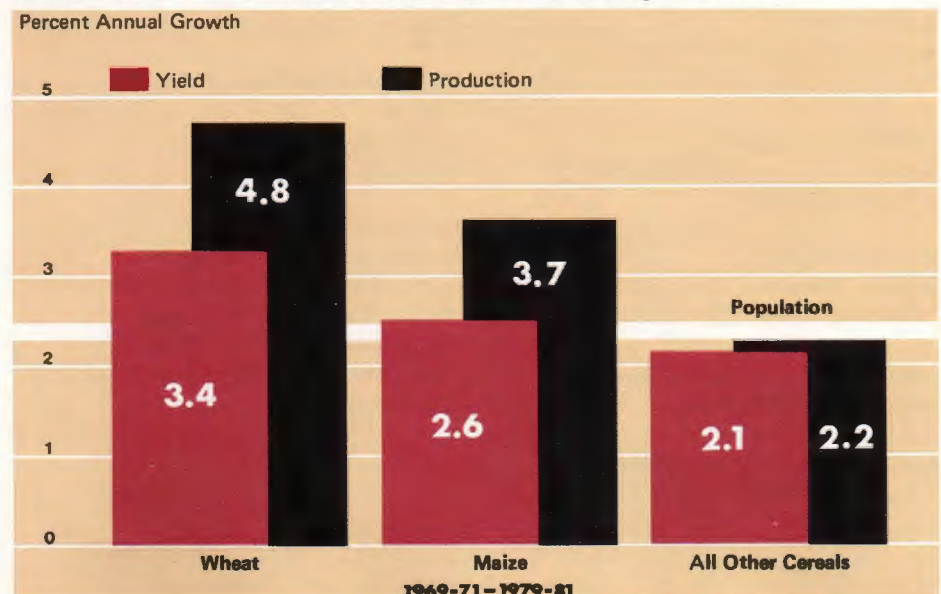
We hope that by bringing this information together in one report we will be able to provide a more complete, timely and informative description of CIMMYT's research and training activities and finances during the year. Additionally, we hope that by including a brief narrative on individual extra-core grants (for which we have an obligation to report under the terms of each grant) we can demonstrate the degree of integration that these grants have within CIMMYT's overall objectives.

During the annual 1982 Centers' Week we reported to the members of the CGIAR some of the important trends in wheat and maize production and consumption in the developing world and tried to describe how these were shaping CIMMYT's program priorities.

Although CIMMYT is not responsible, *per se*, for increasing developing country cereal production—this is principally the task of national research and production organizations—we do consider productivity expansions to be an important measure by which to judge the value of our work.

Over the last decade, the highest cereal production growth rates in the developing world have been achieved in wheat and maize. The crops registered average annual production gains of 4.8 and 3.7 percent, respectively, well ahead of population growth.

Growth Rates of Cereal Yield and Production in Developing Countries



Today, at least 35 million hectares of the developing country wheat area are planted to improved wheat varieties that carry CIMMYT-developed germplasm in their pedigrees. Our conservative estimate of the contribution to increased production solely attributed to the use of these improved varieties is seven million tons, worth US \$1.2 billion this year, and sufficient to provide 50 million people in the developing world with 65 percent of their annual caloric consumption.

To date, most of the benefits of improved wheat germplasm in the developing world have accrued geographically to the major producing countries and, biologically, to the more favored environments in terms of soils and moisture availability. Although CIMMYT's widely adapted, high yielding cultivars have shown that they generally perform as well as, or better than, traditional varieties in the more marginal environments, fewer benefits through the use of improved technology have occurred in these resource-poor areas to date.

Though substantial yield improvements can be achieved and indeed are still necessary in the more favored environments, we do not expect production growth rates in these areas to be as high in the 1980s as in the past decade. It appears to us that the major unexploited production gains to be made in wheat in the developing world during the 1980s will be in the more marginal environments. These include areas in the tropical belt, regions with acidic and saline soils, and areas where moisture stress is prevalent. These production environments pose important research challenges for the 1980s.

Some 54 developing countries produce maize on more than 100,000 hectares. Although aggregate maize production in the developing world increased slightly faster than the population growth rate during the 1960s, this increase was largely due to substantial area expansions under the crop. Yields during the 1960s were improved at an average annual rate of only 1.3 percent, approximately half the rate achieved in wheat and rice.

A totally different and exciting scenario is now becoming apparent. Over the last decade, developing country maize production has been spurred by a 2.6 percent per annum increase in average yield levels, twice the rate of the 1960s. A considerable expansion in the commercial use of improved maize materials is under way in many developing countries. CIMMYT estimates that five million hectares in the developing world are now planted to varieties and hybrids which are based, at least in part, on germplasm selected from international testing program trials.

The increases in maize productivity in developing countries during the 1970s, however, were not uniform. Asia was maize's success story with average production increases of 5.3 percent per annum, primarily the result of the efforts of China and a handful of other countries. In Latin America, improved yield performances were registered in the major countries as well as among some of the smaller producers. While annual average yields increased by 2.5 percent, they were offset by a slight decline in total area. In the Middle East annual production expanded more slowly,

increasing at only 1.2 percent per annum. In Sub-Sahara Africa, less than a one percent annual gain in production and no increase in yield levels was achieved during the 1970s. Only a few countries in the region posted yield increases above population growth rates.

A number of research priorities emerge from a close look at these trends in maize. First and foremost is the need for CIMMYT's germplasm development to be further oriented towards the difficult production and economic environments present in many of the African countries. In a more general sense, the production requirements of resource-poor farmers must also continue to figure prominently in CIMMYT's research priorities. Added resistance to major disease and insect problems and earlier maturing varieties are major germplasm requirements. Considerably more work in crop management research is also needed at the national level. In particular, on-farm research must become an integrated component of national research and production systems.

In general, however, these recent maize and wheat production trends in the developing world are promising signs for the world's future food supply. They represent achievements of national research and production programs, and indirectly of CIMMYT and the CGIAR. Yet there are still many challenges ahead. The research priorities mentioned here are but some of the ways in which technology transfers in the form of agricultural research can hopefully be extended to more of the world's poor. With continued support from the donor community, and strong collaborative links with national programs, we are confident that these challenges can be met.

New Trustees

During the past 18 months considerable changes have occurred in the composition of CIMMYT's international Board of Trustees.

With the change in government in December, 1982, Mexico's new Secretary of Agriculture, **Ing. Horacio García Aguilar** joined the Board and assumed his statutory responsibilities as president of the CIMMYT Assembly, the legal governing body of the Institute.

Several other distinguished scientists and research leaders also joined the Board during this time period. They are:

Phaitoon Ingkasuwan of Thailand, previously rector and currently a professor at Kasetsart University. Dr. Ingkasuwan has an academic background in animal physiology and many years of experience in research and education management.

James R. McWilliam of Australia, Director of the Australian Center for International Agricultural Research. A soil scientist, Dr. McWilliam comes to CIMMYT with a great deal of experience in international agriculture and the CGIAR in particular.

Jesus Moncada de la Fuente of Mexico, Director of the National Agricultural Research Institute (INIA). A soil and plant physiologist, Dr. Moncada has many years of experience in research management. He has also been elected Vice-Chairman of the Board of Trustees.

Stachys N. Muturi of Kenya, Deputy Permanent Secretary, Ministry of Energy. Dr. Muturi began his career as a soil physicist and rose to hold senior positions in government. He has special expertise in policy issues affecting scientific research and development.

Abdoulaye Sawadogo of the Ivory Coast, currently Professor of Economic Geography, University of Abidjan. Dr. Sawadogo is a former Minister of Agriculture with many years of experience both at the national and international level.

We are indeed pleased to have these distinguished individuals join our Board and feel that their special skills and experience will enhance CIMMYT's ability to deal with research problems and opportunities in the years ahead.

Financial Highlights

By any form of measurement, the most significant financial development for CIMMYT in 1982 was the massive devaluation of the Mexican peso. At the end of 1981 the peso stood at 26.06 per dollar; by year-end 1982 that exchange rate was Ps 148.50 per dollar, a decline of almost 500 percent. The devaluation, with the uncertainty and crisis that surrounded it, did not leave CIMMYT untouched although on balance the financial results for 1982 are satisfactory. CIMMYT ended the year with a small surplus of funds, in spite of registering a substantial "translation loss" on peso-denominated items. Both the surplus and the translation loss are the result of CIMMYT being a dollar-funded organization operating in a largely peso-denominated environment.

One of the principal effects of the devaluation was to reduce the dollar value of peso-denominated expenses. Close to 50 percent of CIMMYT's expenses are denominated in pesos. The majority of these are the salary and related costs of the approximately 700 people we employ in Mexico. Also important are the operating costs of the winter wheat program in northern Mexico, the field and laboratory expenses of the four CIMMYT-owned experiment stations, and the office costs

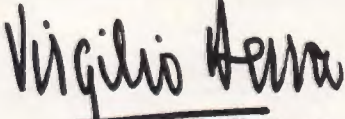
associated with maintaining in Mexico the headquarters of a worldwide organization such as CIMMYT. As a result of the devaluation fewer dollars were needed to support these operations in Mexico and this was the principal reason for the year-end surplus. In fact, the surplus would have been higher had CIMMYT not informed donors who were able to channel funds elsewhere in the CGIAR system.

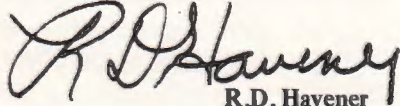
On a more negative note is the translation loss of \$650,000, the result of revaluing in dollars all peso-denominated assets and liabilities at the year end exchange rate of Ps 148.50 per dollar. This is not a paper transaction; rather it represents the write-down of the dollar value of CIMMYT's net assets, mainly accounts receivable. In accordance with Statement No. 52 of the Financial Accounting Standards Board of the United States for entities operating in hyper-inflationary environments, the translation loss is charged directly to 1982 operations.

Looked at from these perspectives, the devaluation was really a two-edged sword: on the one hand reducing the dollar value of peso expenses and thus contributing to a surplus of funds compared to budget, and on the other hand, generating a real financial loss in CIMMYT's net assets related to on-going operations in Mexico.

Other financial bench marks showed very positive results. The cash position at year end was good and sufficient to carry CIMMYT through the traditionally cash-short months at the start of each year. Working capital increased by almost \$200,000. Accounts receivable, although slightly higher than in 1981, were also at an acceptable level. The modest increase in donor receivables is almost entirely due to cost-reimbursable funding, i.e., grants under which payment is made only after the activity has taken place.

In sum, the institute's fund balances increased by just over \$1.0 million, or 9 percent. In a year marked by financial crises in the developing nations and severe recession in the donor countries, we believe this to be a satisfactory result indeed.


Virgilio Barco
Chairman, Board of Trustees


R.D. Havener
Director General

Year in Review



The problems of resource-poor farmers figure heavily in determining CIMMYT's research agenda.

In 1982 through its research, training and regional program networks, CIMMYT collaborated with hundreds of organizations and thousands of scientists worldwide. The Center's primary research thrust is to assist crop scientists from developing countries to produce improved maize, wheat, triticale and barley varieties that are capable of high and dependable yields on farmers' fields. The problems of resource-poor farmers and more difficult production environments remain important criteria in determining the CIMMYT research agenda. In this area, relative priority is given to developing germplasm with improved disease and insect resistance, tolerance to drought and other environmental stresses, and in some cases—such as with triticale—with improved grain quality.

Improved crop management offers another avenue for increasing productivity and for realizing the full advantages of improved varieties. CIMMYT agronomists and economists facilitate national efforts to increase productivity by developing more effective production research techniques. These are then utilized by national programs in developing technologies appropriate for their farmers.

In addition to its crop-oriented research efforts, CIMMYT is heavily engaged in training-related activities. Much of this effort is aimed at strengthening the scientific skills of middle-level national program researchers who attend various in-service training courses. However, many other training opportunities are also offered.

To better support and complement the research and training efforts of more than 125 collaborating national programs, CIMMYT has posted roughly 40 percent of its senior staff to regional program assignments. In addition, a small number of CIMMYT staff are working within selected national programs through extra-core funding.

Reported here are highlights of CIMMYT's 1982 core activities in research and the development of research procedures, training, communications and consultation. Greater detail about the Center's program of work is found in the 1983 *CIMMYT Research Review* and the more than 100 technical reports and the information bulletins published during the last five years.

Maize Program Research Activities

CIMMYT's 1982 activities in maize improvement involved cooperation with scientists in virtually all maize-growing countries. The maize research program is directed towards the development and maintenance of broad-based maize pools and populations that offer higher yield potential and greater environmental dependability for developing country production conditions. The development of disease and insect resistant varieties is a major research objective. Because of weaknesses in the seed production and distribution systems in most collaborating countries, we also emphasize the development of open-pollinated varieties.

Germplasm Development—Many sources of genetic diversity have been used to form the 34 tropical, subtropical and temperate zone gene pools currently being improved and maintained in the maize program. Of these 34 gene pools, 4 are special temperate zone pools constituted to broaden the genetic variability of both tropical and temperate germplasm groups. Thirteen quality protein maize gene pools have also been formed and are being continually improved.

Each of these gene pools is a mass genetic reservoir formed through the mixing of different germplasm with similar adaptation, maturity, grain color and texture. Several new gene pools have been constituted in recent years to better serve the germplasm requirements for highland areas and to offer a broader range of early maturing materials. The formation of gene pools, and their improvement using relatively mild selection pressure for a range of characters, represents the first stage in CIMMYT's maize improvement research methodology.

A major genetic resource base for the development of the CIMMYT gene pools has been the Center's maize germplasm bank—one of the world's largest—with over 13,000 accessions from 46 countries. The bank is operated as a service unit for resident breeders as well as scientific collaborators from other institutions. Hundreds of seed requests for specific collections made by collaborating scientists from around the world were filled in 1982.

As the pool materials have been improved they have begun to provide superior germplasm sources for CIMMYT's more advanced maize populations. The nomenclature "population" really refers to more refined gene pools which have undergone a higher selection pressure and are more uniform. CIMMYT is currently handling 29 such populations—24 normal maize and 5 quality protein maize populations carrying the opaque-2 gene. These materials are suited to a range of developing country climatic conditions (tropical, subtropical, temperate), maturity requirements (early, intermediate, late), and grain preferences (yellow, white, flint, dent).

International Testing—Multilocal testing plays a major role in CIMMYT's maize improvement system. Maize populations are internationally tested at several stages of advancement after the judgment is made that the material offers superior germplasm for some part of the developing world.

After three cycles of improvement in Mexico, populations enter into the international progeny testing trials (IPTTs) in which the best 250 families developed in Mexico are tested at up to six locations worldwide. Based on the

IPTT performance, more-refined experimental varieties are developed from families of the population and tested in subsequent years in experimental variety trials (EVTs).

National collaborators play a key partnership role in the development of these materials. Their on-site selections of superior families within the various populations provide the basis for developing the more-refined experimental varieties. The best experimental varieties are subsequently assembled into elite experimental variety trials (ELVTs), which are also distributed for international testing at many locations.

In 1982, CIMMYT shipped 632 individual maize trials (from 7 different IPTTs and 12 different EVT trials) to collaborators in 73 countries (see Appendix I). Two of the 1982 international testing program trials included CIMMYT's high-yielding, agronomically superior quality protein maize materials.

Since CIMMYT began its current scheme of population improvement and international testing—less than a decade ago—more than 600 experimental varieties have been developed. Twenty-five national programs, drawing on germplasm from the international testing program, have released a total of more than 100 varieties during the last five years. Dozens of new varieties are now in the final stages of national varietal testing programs and commercial release. In addition, larger seed quantities (1-2 Kg) of selected experimental varieties were requested and provided to more than two dozen countries for on-farm testing and national seed multiplication programs.



CIMMYT's most outstanding maize populations to date are full-season materials adapted to lowland tropical and subtropical areas.

Yield Potential—To date, CIMMYT's most outstanding populations are tropical lowland white and yellow grain full season materials. Considerable genetic modifications in the tropical maize plant have been necessary to develop these materials. A major research effort has been made 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. The incidence of lodging has thus been reduced in CIMMYT's maize materials. The plants have also become more responsive to improved management and have an increased yield potential, largely through a higher grain harvest index.

In addition to research to increase the absolute yield potential of full-season tropical maize materials, CIMMYT is also working to develop earlier maturing, high yielding varieties for more intensive cropping systems. An increasing number of early maturing experimental varieties are being developed through the international testing system. Some of the materials tested in 1981 are ready to harvest 20-40 days earlier than many traditional, full-season varieties. These varieties offer some farmers in well-watered as well as in drought-prone areas new alternatives for more profitable farming systems.

Considerable effort has also been made to develop a range of higher yielding materials for the highlands. In 1978, CIMMYT's highland maize breeding program was reorganized. A number of new gene pools have been developed and improved through a shuttle breeding scheme. Selections made for superior agronomic types by a staff member assigned to the Ecuadorian national maize program are shuttled back to Mexico

where they are submitted to heavy selection pressure for ear rots and ear worms. Several new advanced highland maize populations based on these materials were tested for the first time in 1982 in international progeny testing trials. Experimental varieties are now being formed on the basis of the progeny trial data.

Yield Dependability—The maize materials being developed through the international testing program continued to show biological improvements in 1982 for yield dependability. Considerable emphasis has been given to the development of germplasm with reliable field resistance to the major disease problems found in the developing world. Selection is exercised continuously in both pools and populations for leaf blights and rusts. For those important maize diseases not present in Mexico at consequent levels, CIMMYT has entered into a number of special disease-related research projects with other research institutions located in major disease-affected areas (described later in the report). 1982 international testing program results showed that the level of resistance to foliar diseases in the CIMMYT germplasm has been considerably improved.

CIMMYT's insect-rearing laboratory produced enough insect larvae in 1982 to artificially infest and screen selected maize pools and populations for reaction to prevalent and important insects. Techniques have been perfected to raise millions of larvae to infest thousands of maize progenies. Progress has been slow but steady in the insect resistance research. Most evident is the increased resistance developed in selected pools and populations to fall army worm and to certain classes of borers.

The materials coming out of the international testing program are also showing an improved tolerance to stress situations, such as moisture stress, in addition to higher yield potential and superior agronomic characteristics. CIMMYT's germplasm improvement methodology—using a multiple-trait selection index in combination with the multilocal international testing system—has proven its effectiveness in producing broadly adapted materials with improved polygenic resistance and/or tolerance to a host of production problems. In addition to their higher maximum genetic yield potential, the best of these tropical lowland experimental varieties out-yielded local varieties over a broad range of stress conditions.

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 the dull chalky appearance, reduced yield, and vulnerability to ear rots and stored-grain pests have been largely overcome.

Five quality protein maize (QPM) populations are now part of the international testing program. Three of these QPM populations are adapted to the lowland tropics and two to subtropical regions. Various normal-looking white and yellow grain experimental varieties have been developed that are equal or superior in yield potential to the best normal maize varieties under cultivation in many developing areas. Five additional QPM populations are under improvement and are expected to enter the international testing system in the next few years.

A major effort was launched in 1982 to get the top performing QPM varieties into more extensive farm-level verification

trials as a preliminary step to greater commercial production. As part of this effort CIMMYT staff travelled extensively in Latin America and Asia during the year engaging in seminars on the current status of QPM research.

Wide Cross Research—Crosses between maize and several alien genera—*Tripsacum*, sorghum, and millet—were pursued in 1982 to determine the feasibility of capturing 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 tolerance to 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. New collaboration was also started with scientists from the University of Illinois to develop a new “transforming DNA” technique for use in the program.

National collaborators play a key partnership role in CIMMYT's international maize testing program. Their on-site selections of families within the various populations provide the basis for developing more-refined experimental varieties.





CIMMYT's progress in developing triticale as a commercial crop has been a remarkable research achievement. The maximum yield potential of triticale has been doubled over the last 15 years and now stands at a par with CIMMYT's best wheat materials.

Wheat Program Research Activities

CIMMYT's wheat program has expanded its scope over the last 17 years to include research on bread wheat, durum wheat, barley and triticale. Since CIMMYT's inception, over 300 high-yielding wheat, triticale and barley varieties which carry CIMMYT developed and/or distributed germplasm in their parentage have been released by national programs. This record of contribution to varietal improvement is unparalleled in the field of international agricultural research.

The wheat program's central breeding objective is to develop widely adapted, management-responsive germplasm for worldwide distribution with major emphasis on the developing world. Breeding work has broadened over the years from an original emphasis on the development of high-yielding, disease-resistant semidwarf wheat varieties—largely for irrigated production conditions—towards a greater consideration of the biological problems inherent in the more precarious rainfed production environments.

To develop improved materials for these wide-ranging production conditions, tens of thousands of crosses are made and hundreds of thousands of plants are evaluated each year in Mexico at several research sites with very different environments. The shuttling of breeding material between widely differing environments, first in Mexico and later throughout most wheat areas of the world, has led to broad-based genetic adaptation in the CIMMYT materials from 35° N to 35° S latitude where spring wheat is grown.

International Nursery Program—Central to CIMMYT's success in its small grains germplasm development work has been the vast wheat, triticale and barley international nursery network coordinated by the wheat program. Each year, about a million packets of experimental seed are assembled into early and advanced generation screening and yield nurseries for testing at hundred of locations worldwide. These international nurseries have played a key role in CIMMYT's efforts to develop superior germplasm and to speed its distribution to national program collaborators and have served as a unifying thread to bring together the work of thousands of scientists worldwide.

In 1982, collaborating scientists in 96 countries requested 2,568 trials of wheat, triticale and barley from 39 different germplasm nursery categories (see Appendix I). In 1982, CIMMYT added new early-generation (F₂) nursery categories to speed the distribution to national collaborators of useful "segregating" germplasm for specific production problems. New nursery categories were also created for germplasm with early maturing characteristics, suitability for dryland conditions, and tolerance/resistance to special disease, soil, heat and cold stress problems. Given the importance of site-specific screening for many of these problems, there is an increasing reliance on regional and national staff to help guide and implement the germplasm development work. More specific collaborative research arrangements for germplasm screening have also been established with selected national programs strategically located to address a particular problem.

Bread Wheat—The bread wheat program is the largest of CIMMYT's small grains improvement efforts. A broad genetic base is maintained within the breeding material for characters such as yield, wide adaptation, industrial quality and disease resistance. Some of CIMMYT's most promising new wheat materials are the result of a collaborative project with Oregon State University and the Turkish national wheat program to cross spring and winter habit wheats. Roughly 25 percent of CIMMYT's current bread wheat crossing program involves crosses between these two major germplasm groups. The best spring x winter materials included in the 1981 international nursery program showed a 5 to 10 percent higher maximum yield potential and greater yield dependability when compared to the best pure spring habit semidwarf wheat varieties. Added drought and cold tolerance and improved disease resistance were also increasingly evident in some spring x winter materials. A new drought tolerance screening nursery was created in 1982 with CIMMYT's best drought-tolerant bread wheat materials and 50 sets were distributed internationally to interested cooperators for testing.

In 1982, a continuing strong emphasis in bread wheat research was placed on developing 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. Of the three rusts, the achievement of more stable leaf rust resistance has been 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 at such a slow rate that little reduction in

yield levels occurs. Those materials with this low receptivity for infection and long latent period for disease development were extensively used in the 1982 crossing program.

Other disease problems were also under investigation. Efforts continued to develop materials with higher levels of resistance to the fungal diseases of *Septoria* spp. Greater activity also occurred in 1982 to develop 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).

A number of high-yielding bread wheat lines with improved disease resistance and that are better adapted to acid soils with high concentrations of soluble aluminum were tested internationally in 1982. These cultivars have been 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 wheat production areas with acid soils that are high in soluble aluminum and phosphorus-fixing tendencies. New screening nurseries containing CIMMYT's best genetic sources for aluminum tolerance as well as the most advanced aluminum tolerant, high-yielding bread wheat lines were assembled in 1982, and 79 nursery sets were distributed to national collaborators for testing.

CIMMYT's research attention on the problems associated with wheat production in the warmer, more tropical production environments increased considerably in 1982. This research effort is in response to requests for support from non-traditional producer countries who, faced with increasing importation of wheat, want to increase national production. Our research focuses on developing greater resistance to certain diseases, such as *Helminthosporium* and *Fusarium*, and greater tolerance to heat stresses which can affect the tillering and grain-filling abilities of wheat grown in these hotter environments. Three new international nurseries were established in 1982 to distribute CIMMYT's best early and advanced generation materials with *Helminthosporium* resistance and heat tolerance to interested collaborators in the developing world. Ninety-nine nursery sets were requested and sent to collaborators throughout the warmer tropics.

Another important research effort in 1982 involved the development of a broader range of earlier maturing bread wheat germplasm. Such materials are needed where there is only a short growing season available for wheat and/or farmers seek to intensify their cropping systems, such as in the rice/wheat rotation increasingly followed in South Asia. A number of early-maturing advanced lines are resulting from this work. Several high-yielding lines are up to five days earlier-to-maturity and have equal or higher yield potential than the popular short-season variety, Sonalika, which is currently grown on 10 million hectares in the developing world, has become susceptible to new races of leaf rust.



CIMMYT has been highly successful in the development of high-yielding, disease-resistant wheat, triticale and barley varieties. Over 300 varieties released by national programs since 1966 carry CIMMYT-developed and/or distributed germplasm in their parentage.

Durum Wheat—Durum wheat is principally used 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 rainfed production areas in Mediterranean basin countries of North Africa and the Middle East, India, Argentina and Chile). CIMMYT's best durum materials today are equal to, or higher yielding than, the best bread wheat materials.

CIMMYT's 1982 durum crossing program placed a heavy emphasis on improving disease resistance. Efforts to develop durum lines with high levels of stripe rust resistance have been quite successful. However, higher resistance to stem rust, *Septoria* and *Fusarium* is still needed, since high levels of incidence of these diseases are still recorded in many production areas. Good genetic sources of resistance are being fully exploited to pyramid genes for higher and more stable disease resistance. For the first time in 1982, CIMMYT's best F₂ stem rust resistant durum germplasm was assembled into a new nursery and distributed to cooperators for testing in 39 international locations.

More winter x spring crosses were made in 1982 to capitalize on genes found in winter habit durum wheats for enhanced tolerance to cold and drought stress conditions and increased resistance to certain diseases. Efforts to modify the head architecture in the durum plant to reduce the incidence of head-rotting diseases have been quite successful. Efforts continued to develop durum types with solid stems for areas in North Africa, where sawflies can cause serious damage in normal (hollow stem) semidwarf materials. Efforts continued to develop a broader range of earlier maturing varieties

with good yield potential and disease resistance. Such materials are particularly advantageous in areas characterized by drought stress problems and/or a short growing season.

Considerable export potential exists for durum wheats with large size grains, high grain test weights, acceptable pigment and protein content and good gluten strength. To assist collaborating developing countries with the potential to export durum wheat, CIMMYT's cereal quality laboratory staff worked closely with the breeding staff in 1982 to develop durum wheats that maintained high industrial quality characteristics for macaroni processing. Numerous new lines with high yield potential and satisfactory quality characteristics were distributed in 1982.

Triticale—Triticale is a man-made cereal crop that resulted from the successful hybridization of the wheat and rye species. The progress in developing triticale as a commercial crop over the last 15 years has been a remarkable research achievement. CIMMYT's continuing research program in triticale is motivated by several major considerations. One is the greater total dry matter production of triticale versus semidwarf wheats, which gives triticales a combined forage and grain advantage over wheat as a livestock feed. Second, a greater partitioning of triticale's total biomass to grain production could push triticale to higher levels of maximum grain yield potential than wheat. Finally, triticales to date have generally shown very high levels of disease resistance as well as tolerance to agroclimatic and soil stresses, such as cool highland temperatures and acid soils high in aluminum. For the last five years in the highlands of East Africa, for example, the best triticales in regional yield trials have outyielded the best wheats by 20 percent.

To a considerable extent triticale's original problems of lodging have been overcome. Many medium-tall semidwarf triticale types with far improved straw strength have been developed and the number of varieties being released around the world continues to grow. A new range of earlier maturing triticales were sent out for international testing for the first time in 1982. A few of these lines are within 5 days of CIMMYT's earliest maturing wheat materials.

The major drawbacks of triticale continue to be in grain type (test weights), the tendency for the grain to sprout before harvest, and the overly long fruiting period. Although triticales with high grain test weights do exist, these test weights drop sharply as production environments become less favorable. 1982 research data on test weights show some high-yielding triticale lines with more acceptable and stable test weights across various

environments. Some improvements in preharvest grain sprouting have also been made. However, these problems continue to constrain triticale's progress in becoming a commercially accepted crop. Recently, a new race of stem rust has been identified in Australia to which 60 percent of CIMMYT's triticale material is susceptible. This is the first major disease problem reported for triticale and points to the need for increased pathology research activities in the years ahead as the commercial production area of triticale increases.

Barley—In 1972, CIMMYT began work on barley as a human food. In 1982, this improvement program was conducted in direct collaboration with ICARDA, Syria. Substantial progress has been made in the development of barley germplasm with high yield potential, lodging resistance, wide adaptation, hull-less grain types and

higher nutritional quality. The primary problem with CIMMYT's barley materials is their generally high susceptibility to many diseases, especially leaf rust, stripe rust, *Rynchosporium secalis*, *Helminthosporium* spp. and the barley yellow dwarf virus.

In 1982, a shuttle breeding program between Mexico and the Andean zone (where very heavy natural disease levels exist) was initiated to speed the development of disease resistance in CIMMYT's barley materials. More effective artificial disease epidemics were also created in Mexico to impart heavier disease pressure on the materials in order to identify resistant types. Several hundred lines with resistance to several major barley diseases were used extensively in the 1982 crossing program. A new barley yellow dwarf virus nursery was assembled for the first time in 1982 and distributed to 15 locations in cooperating countries.

Exciting progress is being made in CIMMYT's wide cross research program to transfer useful genes from related genera into wheat. CIMMYT's aim is to develop wheat varieties with substantially greater resistance/tolerance to certain diseases and environmental stresses than has been possible within pure wheat germplasm to date.





Work continues at CIMMYT to raise the maximum genetic yield potential of wheat, triticale and barley. Lines have been developed with twice the number of grains per head as compared to present day commercial varieties. Although problems still exist with these experimental materials, this line of research continues to make encouraging progress.

Markedly accelerated progress on correcting the disease susceptibility of CIMMYT's barley materials is expected over the next several years.

Efforts also continued in 1982 to develop a broader maturity range in CIMMYT's barley germplasm. More intensive use was made of winter barley germplasm through spring x winter crosses to develop high-yielding barleys for production areas (such as in Mediterranean countries) requiring long-season 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 were evident in the 1982 advanced-line yield trials.

Germplasm Bank Unit—Until 1981, the wheat program had only a minimum short-term cold storage seed maintenance facility for its four crops. Over the years, CIMMYT has greatly increased the scope and extent of its worldwide collaboration, resulting in an increasing volume of breeding material which should be properly described, classified and maintained. In response, CIMMYT built a new wheat germplasm bank facility, which began operation in late 1981. An inventory was started in 1982 of 70,000 accessions in the existing active breeding collections. The first cycle of classification (10,000 entries) and regeneration of the entries was carried out at CIANO, Sonora, during the 1981-82 growing season. Eventually, a computer program will be developed to assist in the management of this germplasm bank information.

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. During 1982, several new special research projects were either started or expanded. One such project involves the development of separate source populations (gene pools) for resistance to *Helminthosporium* spp. and *Fusarium* spp. in bread wheat, durum wheat and triticale. Another research project is aimed at developing higher yielding rye types as well as bread wheats with particularly high grain quality for use as parental stocks in the development of new triticales with higher yield potential and improved grain quality.

Work also continued in 1982 on yield components. Lines with up to nine grains per spikelet (3-5 are the normal number) and twice the number of spikelets per head have been developed. Grain filling is the principal problem in these crosses. In addition, larger heads are usually 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. Various nurseries were assembled in 1982 with the best materials from several of the special germplasm development research projects and distributed to cooperators for testing at 70 international locations.

WideCross Research—Still another research area receiving greater attention at CIMMYT is the transfer of useful genes from genera related to wheat. Exciting progress is being made in this research program. The primary focus of the work is not necessarily to achieve higher genetic yield potential, *per se*, but rather to obtain better resistance/tolerance to certain diseases and environmental stresses.

The major genera utilized in the program in 1982 were three classes of wild grasses: *Agropyron*, *Elymus* and *Aegilops*. Some *Agropyron* species possess genes for rust and barley yellow dwarf virus resistance and salt tolerance. *Elymus* species have shown excellent drought, salt, cold and heat tolerance, as well as resistance to leafspotting diseases such as *Helminthosporium* and *Fusarium*. The *Aegilops* species also are potential sources of resistance to the leaf-spotting diseases mentioned above. A considerable number of hybrid combinations have been achieved and have produced backcross seed with relative ease. The more advanced backcross progenies were evaluated for the first time in 1981-82 in field trials to determine the levels of increased resistance and/or tolerance that have been conferred.

Agronomy Research—Most of CIMMYT's agronomy research is carried out under the auspices of regional and national programs. However, some agronomy (and physiology) research is under way in Mexico. 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 were also investigated by the agronomy program. Finally, some production-oriented issues relevant to the Yaqui valley and the high plateau areas of central Mexico were investigated as part of the INIA-CIMMYT cooperative wheat improvement program.

Economics Program

CIMMYT's economics program has made a major contribution in the development of field methods to assess the production circumstances of farmers in developing countries and to translate these into priorities for subsequent experimentation. Cost-effective farm-level survey procedures have been developed to help assess (in target research areas) the most important production problems and resource circumstances faced by the majority of farmers. This information is then used to orient subsequent crop research aimed at developing improved technologies. The procedures developed by the economics program staff in conjunction with CIMMYT and national program biological scientists are now being used in many research programs in the developing world.

During 1982, program staff continued with their close involvement in several national on-farm research programs centered mainly in highland areas of Latin America and Africa south of the Sahara. Increasingly, the economics staff have become involved in issues related to the institutionalization of on-farm research within national agricultural research systems.

In late 1981 and early 1982, two new research reports, **World Wheat Facts and Trends** and **World Maize Facts and Trends**, prepared by the economics program staff, were widely distributed around the world. These publications contained data on 30 variables as well as trend analyses on global changes in production, consumption, trade and prices in wheat and maize over the last two decades. Work on the next issues of these reports were well-advanced by the end of 1982. They will contain updates on the data base as well as analyses of global and regional maize and wheat consumption trends.

Work was also under way on specific policy issues, such as policies which favor expanded wheat consumption in non-traditional wheat producing countries. Studies were launched on the comparative advantages of wheat and maize production based on real costs (domestic resource costs) within and between developing countries. The economics staff is also considering ways to develop cost-effective research procedures to aggregate, analyze and present information generated through on-farm surveys and trials for use at national policy making levels.

Other efforts in 1982 to generate primary data included the continuing collection of information on various wheat production environments in the developing world to provide CIMMYT with a better data base to determine priorities and plan its future program of work.



CIMMYT's protein quality laboratory staff and maize breeders have worked together closely in the development of high-yielding, hard endosperm, quality protein maize (QPM) varieties. This research collaboration has been a major factor in the significant progress in the QPM improvement project to date.

Research Support

CIMMYT has three principal research support units: experiment stations, laboratory services and data processing. In 1982, CIMMYT had access to 450 hectares of land on seven experiment stations (4 belonging to CIMMYT, 3 belonging to INIA) located in different ecological areas of Mexico. CIMMYT's major station development has been largely completed. Only continuing improvements in irrigation and drainage systems and in soil conservation management occurred in 1982.

The major 1982 activities of the laboratories continued to be in total protein and protein quality evaluations (mainly maize) and milling and baking evaluations (mainly small grains). Laboratory methods to screen large numbers of wheat, triticale, barley and maize seedlings for tolerance to aluminum toxicity continued in 1982. A high correlation with field response exists with the laboratory data, and it has provided breeders with an effective, low-cost method to screen large quantities of germplasm.

Major expansions were carried out in CIMMYT's data processing services during 1982. In March, a new computer was installed and extensive physical changes were made to the data processing building. Two programming specialists from Canada joined the data processing group on 1-2 year appointments and extensive use of consultants was also made. This new staffing plan has greatly increased the capacity of the data processing unit to develop more efficient computer programs to meet CIMMYT's growing research and management needs for data processing.

Training

Training continued to be a major dimension of CIMMYT's total program effort in 1982. Training activities in Mexico, within the regions and in national program settings, stressed the strengthening of applied research skills needed to conduct effective crop research programs.

Maize Training—In 1982, forty-six maize scientists from 24 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. 70 percent of the in-service trainees were enrolled in the crop production course.

Another 15 visiting scientists were provided travel fellowships to visit CIMMYT during the year, spending from 1 week to 3 months in Mexico. During 1982, CIMMYT also cooperated in the training of 11 master's degree students and 1 predoctoral candidate. In addition, 6 postdoctoral fellows and 3 associate scientists were in residence in Mexico during the year. In-country training programs in maize crop production were also conducted in Bolivia, Honduras, Kenya and Pakistan.

Wheat Training—During 1982, fifty-one wheat scientists from 26 countries participated in CIMMYT's in-service training courses offered in breeding, pathology, crop production, cereal technology and experiment station management (see Appendix II). A trend

observed in recent years—growing enrollment in the production agronomy course—continued in 1982. Travel fellowships for 17 visiting scientists were provided in 1982. CIMMYT also cooperated in the training of 12 master's degree students. In addition, 8 postdoctoral fellows and 2 associate scientists were in residence within the wheat program during 1982. An in-country training program in wheat crop production was also carried out in Ecuador.

Economics Training—The economics staff continued their participation in 1982 in the maize and wheat production training

courses held in Mexico. In addition, new emphasis was given to the development of a format and materials for in-country training on the process of on-farm research. Two programs were under way and more are to come. Cost-efficiency is a major consideration. One predoctoral fellow and one postdoctoral fellow also worked within the economics program during 1982. Both were involved in on-farm research and training. One was assigned to the East African regional economics program and worked in Kenya to train economists engaged in farm-level survey research. The other, located in Haiti, assisted CIMMYT's regional economics and maize staff assigned to Central America, Mexico and the Caribbean in a cooperative national maize improvement and production program.

CIMMYT's in-service training program in maize crop management research emphasizes the use of zero-tillage production. Research has shown that major cost savings and substantially less soil erosion can be achieved through the commercial use of appropriate zero-tillage technologies in much of the developing world.





Most of CIMMYT's efforts in crop management research are conducted at the national program level. Effective on-farm research procedures have been developed which integrate the efforts of economists and biological scientists towards the problems of representative farmers.

Regional Programs

During 1982, twenty-five senior staff members were assigned to regional maize, wheat and economics programs. A new regional program, the Eastern and Southern African regional maize program based in Kenya, was launched in late 1982. Several staff changes occurred during the year. The North and West African regional wheat program staff was increased to two, with the reassignment of a pathologist from headquarters. The Andean regional wheat program was augmented through the addition of a regional agronomist. A maize agronomist also joined the Asian regional maize program. Finally, the Andean regional economics program was brought to a conclusion and this position is being redeployed to strengthen CIMMYT's regional economics program efforts in South and Southeast Asia.

CIMMYT regional program staff members 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 competence in germplasm development and crop management problems not easily addressed in Mexico.

Maize—In maize, a number of disease-related research projects, originally organized between CIMMYT headquarters staff and national collaborators in strategically located countries, have been reorganized so that the center of activities

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 downy mildew project is centered in the Asian regional program with full involvement of Thai and other Asian national scientists. Likewise, we have shifted streak virus resistance research to

Regional Program Staff 1982

Region	Maize	Wheat	Economics
Central America, Mexico & Caribbean	3	0 ^a	1
Andean countries	3	2	1 ^c
South American Southern Cone	0	2	0
North & West Africa	2	2	0
Middle East	1	2 ^{b, d}	0
Eastern and Southern Africa	1	1 ^d	1
Asia	1 ^d	1	1 ^c
Total	11	10	4

^{a/} Handled from Mexico by headquarters staff

^{b/} One staff member was assigned to the regional disease surveillance project and the other to ICARDA

^{c/} Staff resignation occurred during the year

^{d/} Associate research staff from other international organizations were also directly involved in these regional programs

the West African region with full involvement of IITA and West African national scientists. The work on corn stunt is carried out from headquarters with full involvement of scientists from several Central American national maize programs. Good progress has been made in developing high-yielding varieties with increased resistance to downy mildew and corn stunt virus.

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 are now being incorporated into one of CIMMYT's high-yielding tropical lowland populations. In 1982, an international progeny testing trial of these streak-resistant materials was conducted

for the first time. High-yielding experimental varieties with enhanced streak virus resistance have been extracted from the IPPT and will be tested in the 1983 international experimental variety trials.

Wheat—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. For the Middle East, parts of Asia and Africa, a regional disease surveillance trap nursery was distributed to cooperators in 1982. Two regional disease surveillance nurseries were also prepared and distributed by the Andean regional program staff, in cooperation with Ecuador's national wheat research program. Regional screening and yield trials were also prepared by the regional wheat staff assigned to the Southern Cone and Eastern and Southern Africa. In addition, the staff assigned to the East Africa program assisted the Kenyan national government

in the operation of an extensive off-season nursery program as a service to the other African and Asian national research programs.

Economics—In the economics program, regional economists were mainly engaged in collaborative national research projects in more than a dozen countries to demonstrate the utility of farm surveys for identifying critical factors related to farmer circumstances and for planning effective on-farm research programs. A number of collaborating national programs in Africa and Latin America were actively engaged in 1982 in the institutionalization of on-farm research within their overall national research and production systems. The regional staff have become increasingly involved in organizational issues related to the operation of national on-farm research systems.

CIMMYT staff increasingly are engaged in training programs outside of Mexico. A number of workshops and other courses are offered each year on a regional or national program basis.





CIMMYT's senior scientific staff carry on a heavy schedule of consultation with developing country scientists and research leaders. In addition to giving advice on significant production-related problems in which CIMMYT has expertise, continuing consultation with national programs provides CIMMYT with needed feedback to keep its program activities on track.

Information

In 1982, CIMMYT published 40 new titles and distributed them according to interest areas within a mailing list of 4,500 names. Many other papers were also prepared for presentation at international and national meetings, most of them being published elsewhere. (See Appendix III.) A new computerized mailing list system was put into operation in 1982. This system allows CIMMYT to better target its communications with key client groups. In addition, plans were formalized to expand significantly CIMMYT's activities in the preparation of training-related teaching materials. A major objective of the proposed instructional materials will be to backstop national program efforts to develop their own capacity for in-service training of their staffs. CIMMYT's large training alumni network (numbering over 2,500 individuals from 86 countries) will play a key role in increasing the multiplier effect of CIMMYT's training efforts in Mexico and elsewhere.

Consultation

The active consultation schedules of the CIMMYT staff (over 3,000 man days in 62 countries in 1982) 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. In 1982, 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 also served to provide follow-up support to former CIMMYT trainees as well as to identify new prospective training program candidates. Finally, CIMMYT's senior staff members were frequently called upon by national research leaders to advise on the organization of national maize and wheat research programs as well as significant production-related problems in which CIMMYT has expertise.

APPENDIX I
Distribution of international maize trials, 1980-82

Region and country	1980 trials	1981 trials	1982 trials	Region and country	1980 trials	1981 trials	1982 trials
Central America, Mexico and Caribbean	199	137	181	Guinea	—	2	—
Bahamas	1	1	2	Guinea-Bissau	4	4	5
Barbados	2	2	9	Ivory Coast	14	9	6
Belize	5	3	6	Kenya	16	7	6
Costa Rica	8	8	9	Lesotho	6	—	—
Cuba	—	—	3	Liberia	—	—	5
Dominican Republic	11	12	6	Malawi	19	12	10
El Salvador	8	4	7	Mali	6	4	7
Grenada	1	1	—	Mauritania	2	2	—
Guatemala	20	10	16	Mozambique	22	8	18
Haiti	10	—	—	Niger	—	1	—
Honduras	19	12	20	Nigeria	31	10	12
Jamaica	3	3	8	Rep. South Africa	11	11	10
Mexico	69	41	63	Reunion	1	8	—
Nicaragua	9	9	18	Rwanda	6	—	—
Panama	24	28	14	Senegal	13	6	10
St. Kitts	1	1	—	Sierra Leone	17	21	—
Trinidad	8	3	—	Somalia	4	4	5
				Sudan	2	6	5
South America	132	101	88	Swaziland	5	7	6
Argentina	13	4	5	Tanzania	7	5	5
Bolivia	14	10	15	Togo	4	4	14
Brazil	23	38	38	Transkei	4	2	2
Chile	2	—	2	Uganda	6	5	7
Colombia	10	2	1	Upper Volta	8	11	5
Ecuador	14	7	2	Zaire	8	4	6
French Guiana	2	—	—	Zambia	4	4	—
Paraguay	2	5	4	Zimbabwe	—	6	9
Peru	31	10	12	South and East Asia	103	81	130
Surinam	5	—	—	Afghanistan	—	—	4
Uruguay	0	2	1	Bangladesh	5	4	8
Venezuela	16	14	8	Burma	8	6	1
				China	—	3	—
Mediterranean/Mideast	51	41	30	India	24	12	20
Algeria	2	—	1	Indonesia	3	2	7
Egypt	11	7	5	Korea, South	2	2	1
Iraq	2	4	—	Malaysia	6	3	7
Jordan	2	—	—	Nepal	7	5	8
Libya	—	2	2	Pakistan	17	12	23
Morocco	3	3	5	Philippines	10	—	13
Saudi Arabia	6	6	3	Sri Lanka	5	6	—
Syria	3	—	—	Thailand	12	12	14
Turkey	12	9	8	Vietnam	4	8	22
Yemen A.R.	6	10	6	Other	13	14	14
Yemen, South	4	—	—	France	—	—	2
				Germany, Fed. Rep.	—	—	3
Sub-Sahara Africa	289	204	189	Greece	4	2	2
Angola	3	2	11	Puerto Rico	3	—	—
Benin	6	5	4	Spain	2	—	—
Botswana	4	2	—	Tahiti	1	1	1
Burundi	13	—	—	USA	—	6	6
Cameroon	8	8	10	Yugoslavia	3	5	—
Cape Verde	—	—	3	TOTAL TRIALS	787	578	632
Central African Republic	—	2	—	TOTAL COUNTRIES	88	84	73
Congo	6	2	4				
Comoros	—	2	—				
Ethiopia	21	10	—				
Ghana	8	8	4				

APPENDIX I (cont'd)

Distribution of international bread wheat, durum, triticale and barley nurseries, 1982

	Bread wheat	Durum	Triti- cale	Barley		Bread wheat	Durum	Triti- cale	Barley
Latin America	285	89	153	123	Asia	180	38	73	92
Argentina	36	14	17	5	Afghanistan	4	5	2	5
Bolivia	16	12	7	7	Bangladesh	20	3	2	9
Brazil	46	7	20	9	Burma	8	1	2	1
Chile	19	8	6	12	China	45	2	16	26
Colombia	18	—	6	12	India	12	5	7	7
Costa Rica	5	2	4	3	Indonesia	3	1	1	1
Dominican Republic	3	—	3	5	Japan	1	—	—	—
Ecuador	15	2	8	11	Korea, North	1	—	1	2
Guatemala	10	—	5	—	Korea, South	2	1	4	4
Guyana	7	—	4	3	Nepal	9	—	2	3
Mexico	62	23	49	22	Pakistan	29	5	13	10
Nicaragua	1	—	2	1	Philippines	16	6	10	5
Paraguay	15	1	5	4	Sri Lanka	6	—	—	1
Peru	25	20	14	23	Taiwan	4	—	1	3
Uruguay	6	—	1	1	Thailand	18	9	11	13
Venezuela	1	—	1	—	Vietnam	2	—	1	2
Africa	156	87	79	95	Oceania	14	7	14	4
Algeria	8	11	4	10	Australia	7	3	8	1
Angola	2	1	2	—	New Zealand	7	4	6	3
Botswana	2	—	—	—	Europe	136	104	123	99
Burundi	3	—	1	—	Albania	10	6	5	5
Cameroon	8	2	5	2	Austria	1	2	3	2
Cent. Afr. Rep.	1	—	1	—	Belgium	2	—	—	—
Egypt	10	11	6	2	Bulgaria	—	5	4	—
Ethiopia	13	10	3	12	Czechoslovakia	4	—	—	—
Ghana	1	—	1	20	England	6	—	1	4
Kenya	11	6	7	14	Finland	1	—	—	1
Liberia	1	—	2	1	France	12	7	11	15
Libya	8	8	—	7	German D. Rep.	2	—	4	5
Malawi	7	—	3	3	Germany, F. Rep.	2	6	2	2
Morocco	5	9	2	9	Greece	7	8	7	7
Mozambique	4	1	2	—	Hungary	3	1	4	—
Niger	1	—	—	1	Ireland	2	—	—	—
Nigeria	4	1	2	1	Italy	10	14	10	7
Rwanda	3	—	2	—	Malta	—	3	—	3
Senegal	2	—	—	—	Norway	3	—	2	2
South Africa	18	13	11	16	Poland	8	—	12	2
Sudan	3	—	1	—	Portugal	8	10	9	8
Tanzania	12	3	6	3	Rumania	6	2	7	7
Tunisia	8	11	5	11	Spain	28	30	24	19
Uganda	7	—	4	3	Sweden	6	—	4	1
Upper Volta	1	—	6	1	Switzerland	—	—	3	—
Zaire	1	—	2	—	USSR	7	3	4	2
Zambia	11	—	7	—	Yugoslavia	8	7	7	8
Zimbabwe	4	—	—	—	North America	85	24	53	41
Mideast	86	66	23	73	Canada	17	8	20	15
Cyprus	3	4	3	6	USA	68	16	33	26
Iran	6	2	—	5	TOTAL				
Iraq	6	6	2	6	NURSERIES	942	415	518	528
Israel	15	5	2	7	TOTAL COUNTRIES	91	62	84	79
Jordan	6	8	—	4					
Lebanon	2	3	—	1					
Quatar	1	—	—	1					
Saudi Arabia	4	1	—	2					
Syria	21	19	10	21					
Turkey	18	14	4	16					
Yemen	4	3	2	4					

APPENDIX II
Origin of maize in-service trainees, 1971-82

Region and country	1971-		Region and country	1971-	
	82	1982		82	1982
Central America, Mexico and Caribbean	183	9	South and East Asia (Cont'd)		
Belize	6	0	Nepal	22	2
Costa Rica	11	1	Pakistan	38	2
Dominica	1	0	Philippines	20	0
Dominican Republic	14	0	Thailand	35	4
El Salvador	22	0	Vietnam	2	0
Grenada	1	0	North Africa and Mideast	42	4
Guatemala	17	0	Algeria	1	0
Guyana	1	0	Egypt	19	2
Haiti	14	1	Syria	2	1
Honduras	25	0	Tunisia	3	0
Mexico	36	4	Turkey	14	1
Nicaragua	20	2	Yemen A.R.	3	0
Panama	15	1	Sub-Sahara Africa	173	19
South America	91	3	Botswana	2	0
Argentina	11	0	Cameroon	2	1
Bolivia	10	0	Cape Verde	1	0
Brazil	3	0	Ethiopia	6	0
Colombia	14	1	Ghana	27	5
Chile	2	0	Ivory Coast	4	0
Ecuador	19	0	Kenya	5	0
Peru	24	2	Malawi	5	1
Venezuela	8	0	Mozambique	3	0
South and East Asia	161	11	Nigeria	14	2
Afghanistan	6	0	Rwanda	1	0
Bangladesh	11	2	Senegal	2	1
Burma	1	0	Swaziland	1	0
India	10	0	Tanzania	55	3
Indonesia	4	1	Transkei	1	0
Japan	7	0	Uganda	3	2
Korea	2	0	Zaire	32	2
Malaysia	3	0	Zambia	9	3
			Other	3	0
			TOTAL TRAINING FELLOWS	653	46
			TOTAL COUNTRIES	61	24

APPENDIX II (cont'd)
Origin of wheat in-service trainees, 1966-82

	1966- 1982	1982		1966- 1982	1982
Latin America	182	16			
Argentina	14	0	Sub-Sahara Africa	81	9
Bolivia	20	4	Cameroon	4	1
Brazil	19	1	Chad	1	0
Chile	13	1	Ethiopia	15	1
Colombia	6	1	Kenya	10	2
Dominican Republic	2	1	Lesotho	2	1
Ecuador	19	1	Madagascar	2	0
Guatemala	9	1	Malagasy	1	0
Guyana	2	1	Malawi	3	1
Honduras	1	0	Mali	3	0
Mexico	45	0	Mozambique	1	0
Panama	1	0	Nigeria	16	1
Paraguay	7	1	Rwanda	2	0
Peru	25	5	Senegal	2	0
Uruguay	1	0	Somalia	1	0
			Tanzania	8	2
North Africa and Mideast	211	7	Transkei	1	0
Algeria	54	0	Uganda	1	0
Cyprus	2	0	Zaire	2	0
Egypt	14	0	Zambia	7	0
Iran	8	0	Asia	170	18
Iraq	5	0	Afghanistan	13	0
Jordan	7	0	Bangladesh	42	5
Lebanon	4	0	Burma	2	1
Libya	4	0	India	18	0
Morocco	20	0	Korea	12	2
Saudi Arabia	2	0	Nepal	19	1
Sudan	3	0	Pakistan	53	3
Syria	7	0	Philippines	5	2
Tunisia	27	1	Sri Lanka	1	1
Turkey	48	0	Thailand	4	3
Yemen	3	0	Other Countries	23	1
			France	1	0
			Hungary	2	0
			Poland	3	0
			Portugal	3	0
			Rumania	2	0
			Spain	4	1
			USA	4	0
			USSR	4	0
			TOTAL TRAINING FELLOWS	667	51
			TOTAL COUNTRIES	67	29

APPENDIX III

Publications Released by CIMMYT in 1982

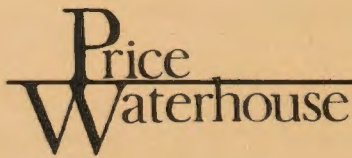
	Language	Pages	Press Run
ADMINISTRATION			
CIMMYT Today No. 13, CIMMYT Economics	French	15	1,500
CIMMYT Today No. 15, Wheat Production in Bangladesh	English	16	6,000
CIMMYT Review 1982	English	130	4,000
CIMMYT 1983-84 Biennial Budget Request	English	48	750
Brochure-Training at CIMMYT	English	23	2,000
	Spanish	25	2,000
MAIZE			
Maize Diseases - A Guide for Field Identification	French	93	1,500
Techniques for Efficient Mass Rearing and Infestation in Screening for Host Plant Resistance to Corn Earworm, <i>Heliothis Zea</i>	English	16	1,500
1981 Intl. Maize Testing Program, Preliminary Report	English/Spanish	340	1,500
Chemical Methods used by CIMMYT to Determine Protein Quality of Cereals	Spanish	39	1,000
WHEAT			
Field Manual of Common Wheat Diseases and Pests	French	69	1,500
Germplasm Movement in the CIMMYT Wheat, Triticale and Barley Programs	English	19	1,000
	Spanish	20	500
Regional Symposium on Wheat and Triticale - Rwanda	English/French	149	300
Results of the 11th Intl. Durum Screening Nursery (IDSN) 1979-80 (IB 72)	E.S.F.*	22	750
Results of the 11th Intl. Triticale Screening Nursery (ITSN) 1979-80 (IB 73)	E.S.F.*	39	750
Results of the 7th Intl. Barley Observation Nursery (IBON) 1979-80 (IB 74)	E.S.F.*	40	750
Results of the 17th Intl. Spring Wheat Yield Nursery (ISWYN) 1980-81	E.S.F.*	81	750
Results of the 12th Intl. Triticale Yield Nursery (ITYN) 1980-81	E.S.F.*	86	750
Results of the 12th Intl. Triticale Screening Nursery (ITSN) 1980-81	E.S.F.*	32	750
Results of the 12th Intl. Durum Screening Nursery (IDSN) 1980-81	E.S.F.*	39	750
Results of the 10th Elite Durum Yield Trial (EDYT) 1980-81	E.S.F.*	49	750
Results of the 12th Intl. Durum Yield Nursery (IDYN) 1980-81	E.S.F.*	57	750
Results of the 14th Intl. Bread Wheat Screening Nursery (IBWSN) 1980-81	E.S.F.*	73	750
Results of the 2nd Elite Selection Wheat Yield Trial (ESWYT) 1980-81	E.S.F.*	27	750
Results of the 18th Intl. Barley Observation Nursery (IBON) 1980-81	E.S.F.*	71	750
Results of the 3rd Intl. Barley Yield Trial (IBYT) 1980-81	E.S.F.*	51	750
Results of the 11th Intl. Septoria Observation Nursery (ISEPTON) 1980-81	E.S.F.*	26	750

* English, Spanish, French

APPENDIX III (cont'd)
Publications Released by CIMMYT in 1982

	Language	Pages	Press Run
ECONOMICS			
Working Paper Series			
Farmers' Practices, Production Problems and Research Opportunities in Barley Production in the Calpulalpan/Apan Valley, Mexico	Spanish	57	300
An Agro-Economic Evaluation of Maize Production in Three Valleys of the Peruvian Andes	Spanish	24	300
Exercises in the Economics Analysis of Agronomic Data	English	66	300
Maize in North Veracruz State, Mexico—Farmer Practice and Research Opportunities	English	30	300
Developing Technologies Appropriate to Farmers Circumstances: Restricted Focus in Farming Systems Research	Spanish	28	300
Data Collection Site Selection and Farmer Participation in On-Farm Experimentation	English	40	300
Including Dietary Concerns in On-Farm Research: An Example from Imbabura, Ecuador	English	38	300
The Rate and Sequence of Adoption of Improved Cereal Technologies	English	44	300
Reprints			
Improving Maize Production in Latin America	English	10	500
	Spanish	10	500
Improving Adaptation and Yield Dependability in Maize in the Developing World	Spanish	19	700
Feeding Mankind in the 1980s: the Role of International Agricultural Research	English	33	750

Independently Audited Financial Statement



México, D. F., February 11, 1983

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, 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, 1982, and 1981, and the results of its operations and the changes in its financial position for the years then ended, in conformity with generally accepted accounting principles 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 6, 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

Centro Internacional de Mejoramiento de Maiz y Trigo, A. C.
Statement of Condition

Currency: Thousands of U.S. Dlls.

Assets

	As of December 31	
	1982	1981
Current Assets		
Cash on Hand and in Banks	645	1,582
Short-Term Investments (Note 2)	2,608	2,050
	3,253	3,632
Accounts Receivable		
Donors (Note 2)	1,307	690
Others (Note 6)	453	528
	1,760	1,218
Inventories	78	231
	5,091	5,081
Fixed Assets (Note 2)		
Vehicles	2,701	2,251
Furniture, Fixtures and Equipment	2,956	2,635
Buildings	5,989	5,797
Land	464	464
Other Fixed Assets	372	372
	12,482	11,519
Other Assets		
Guarantee Deposits	1	1
	1	1
Total Assets	17,574	16,601

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

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

	As of December 31	
	1982	1981
Current Liabilities		
Payments in Advance—Donors (Note 2)	214	830
Vouchers Payable	3,292	2,663
Seniority Premiums (Note 2)	87	64
Accrued Taxes	—	186
Accrued Miscellaneous Expenses	—	16
Accounts Payable—Donors	42	42
Total Current Liabilities	3,635	3,801
Capital Grants, Unexpended Funds and Reserves		
Capital		
Fully Expended on Fixed Assets (Note 2)	12,482	11,519
Operating Funds (Note 4)	1,540	1,540
	14,022	13,059
Unexpended Funds		
Core-Unrestricted	800	15
Core-Restricted	19	19
Extra-Core and Cooperative Projects	(48)	(48)
Auxiliary Services	16	(25)
Translation Effect (Note 3)	(962)	(312)
	(175)	(351)
Trustees Reserve	92	92
Total Capital Grants, Unexpended Funds and Reserves	13,939	12,800
Total Liabilities and Capital	17,574	16,601

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

Centro Internacional de Mejoramiento de Maiz y Trigo, A. C.
Comparative Statement of Activity

Currency: Thousands of U.S. Dlls.

	Year ended December 31	
	1982	1981
Revenue (Note 5)		
Grants	20,825	20,337
Administrative Fees	869	533
Sale of Crops	27	26
Interest on Investments in Marketable Securities	349	214
Auxiliary Services	586	719
Other Income	—	3
Total Revenue	22,656	21,832
Expenses (Note 5)		
Research Programs	13,026	12,771
Conferences and Training	2,277	2,560
Information Services	534	691
General Administration	1,912	1,821
Plant Operations	2,253	2,032
Capital Acquisitions	364	326
Auxiliary Services	545	723
Indirect Costs	869	533
Seniority Premiums	50	50
Operating Funds (Note 4)	—	325
Total Expenses	21,830	21,832
Excess of Revenue over Expenses before Translation Effect		
	826	—
Translation Effect for the Year (Note 3)	(650)	(60)
Net Excess (deficit) of Revenue over Expenses	176	(60)
Unexpended Funds, Opening Balance	(351)	(291)
Closing Balance Unexpended Funds as per Statement of Condition	(175)	(351)

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

Centro Internacional de Mejoramiento de Maiz y Trigo, A. C.
Statement of Changes in Financial Position

Currency: Thousands of U.S. Dlls.

	Year ended December 31	
	1982	1981
Financial Resources were Provided by:		
Revenue	22,656	21,832
Capitalization of Fixed Assets Purchased in the Year		
Core-Unrestricted Grants	866	1,260
Core-Restricted Grants	—	250
Extra-Core Grants	97	—
Increase in Operating Funds	—	325
Translation Effect of the year—Net	(650)	(60)
Decrease in Other Assets	—	3
	22,969	23,610
Financial Resources were Used for:		
Expenses	21,830	21,832
Purchases of Fixed Assets		
Core-Unrestricted Grants	866	1,260
Core-Restricted Grants	—	250
Extra-Core Grants	97	—
	22,793	23,342
Increase in Working Capital	176	268
Analysis of Increases (Decreases) in Working Capital Accounts		
Cash on Hand and in Banks	(937)	702
Short-Term Investments	558	1,797
Accounts Receivable:		
Donors	617	538
Others	(75)	(491)
Inventories	(153)	(4)
Payments in Advance—Donors	616	(830)
Vouchers Payable	(629)	(1,870)
Seniority Premiums	(23)	(2)
Accrued Taxes	186	178
Accrued Miscellaneous Expenses	16	250
Increase in Working Capital	176	268
Working Capital at Beginning of Year	1,280	1,012
Working Capital at End of Year	1,456	1,280

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

Notes to the Financial Statements

December 31, 1982 and 1981

\$US 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 generally accepted accounting practices 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. (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 Mexico.

b. During periods of cash surplus CIMMYT makes short-term investments in marketable securities. Those denominated in dollars are transacted in the U.S. or Eurodollar 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. These are non-negotiable fixed rate instruments. Interest is credited to income as accrued.

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

d. Fixed Assets—Amounts are stated at acquisition cost. Up to 1971 all purchases of property and equipment were recorded as expenses. In 1972 the Consultative Group 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 Consultative Group on International Agricultural Research. 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.

In 1981 the first phase of a program to modernize CIMMYT's computer facilities was completed, resulting in additions to capital of US\$697,000. Phase two of this project was completed in 1982 amounting to US\$277,000.

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

e. 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.

f. 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 US\$50,000 in 1982 (US\$216,000 in 1981) and CIMMYT had recorded a liability of US\$87,000 in 1982 (US\$63,000 in 1981). The charge to income for the year amounted to US\$50,000 in 1982 (US\$50,000 in 1981) 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.

g. Income Recognition: Core unrestricted pledges (also referred to as 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.

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, 1982 CIMMYT had Mexican peso assets and liabilities amounting to Ps 30,823,000 (Ps 31,927,000 in 1981) and Ps 15,968,000 (Ps 12,664,000 in 1981), which were included in the statement of condition at their US dollar equivalents resulting from applying the year-end rate of Ps 148.50 per dollar.

During 1982 the value of the Mexican peso compared to the dollar fell from Ps 26.06 in January to Ps 148.50 at year end. This devaluation gave rise to a translation loss aggregating US\$650,000 for the year. In 1981 the Mexican peso suffered a smaller devaluation from Ps 23.62 to Ps 26.06, which yielded a translation loss of US\$60,000. In accordance with FAS 52, where the firm is judged to be operating in a hyper inflationary environment and the dollar is therefore the functional currency, the translation effect in each year is charged to current income.

On December 20, 1982 the exchange controls existing in Mexico were relaxed and a free exchange market was allowed to operate along with the controlled market. In general terms, all income from the export of goods, all funds needed by in-bond jobbing companies to cover locally-incurred costs and expenses, and all loans received from foreign banks and other foreign financial entities must be exchanged through the controlled market. Foreign currency will be made available through that market for repayments of principal and payments of interest relative to such loans, payments to foreign suppliers for goods imported prior to December 20, 1982, and payments of certain goods imported after that date specifically designated by the Commerce Department. The sale of foreign currency

in the controlled market is subject to its availability. Foreign currency liabilities payable in Mexico incurred prior to December 20, 1982 will be liquidated in pesos as a special exchange rate fixed by the Banco de Mexico; similar liabilities incurred after December 20, 1982 will be liquidated at the controlled market rate. All exchange transactions not specifically assigned to the controlled market will be handled in the free market, without any restrictions.

At February 11, 1983 date of issuance of the financial statements, the exchange rates with the US dollar were as follows:

	Buy	Sell
	Pesos/U.S. dollar	
Special	77.42	—
Controlled	101.89	101.99
Free	147.90	149.40

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 1981 CIMMYT increased its operating funds by US\$325,000; in 1982 there was no increase 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 3). 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 three 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. 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.

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 Investments in Marketable Securities. Surplus cash is invested in short-term 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 1982 and 1981 their expenses were as follows:

	1982	1981
Maize	4,450	4,123
Wheat	5,945	4,952
Economics	558	835
Experiment Stations	1,742	2,159
Laboratories	102	328
Data Processing	142	369
Others	87	5
Total	13,026	12,771

Note 6 – Accounts receivable – others:

In 1982 and 1981 Accounts Receivable—Others were comprised as follows:

	1982	1981
Loans to Senior Staff	164	—
Personal Charges to Employees	(23)	(15)
Official Expenses		
Advances	98	210
Employee Credit Union	3	66
Government of Mexico	31	81
Miscellaneous Debtors	180	186
Total	453	528

A program of loans to senior staff, mainly to provide partial financing for house purchases, was initiated in 1982. Loans are given at 1.25% over the prime rate in the US, the same terms at which CIMMYT borrows funds, so that no donor funds can be considered utilized for this program.

Detailed Statement of Activity

For the Period January 1 to December 31, 1982

Exhibit 1

Currency: Thousands of U.S. Dlls.

	Core Unrestricted	Core Restricted	Extra Core Cooperative	Auxiliary Services	Total
Revenue (Note 5)					
Grants	14,082	4,233	2,510		20,825
Administrative Fees	869	—	—	—	869
Sale of Crops	27	—	—	—	27
Interest on Investments in Marketable Securities	349	—	—	—	349
Auxiliary Services	—	—	—	586	586
Other Income	—	—	—	—	—
Total revenue	15,327	4,233	2,510	586	22,656
Expenses (Note 5)					
Research Programs	8,148	3,140	1,738	—	13,026
Conferences and Training	1,281	493	503	—	2,277
Information Services	534	—	—	—	534
General Administration	1,912	—	—	—	1,912
Plant Operations	2,253	—	—	—	2,253
Capital Acquisitions	364	—	—	—	364
Auxiliary Services	—	—	—	545	545
Indirect Costs	—	600	269	—	869
Seniority Premiums	50	—	—	—	50
Operating Funds	—	—	—	—	—
Total expenses	14,542	4,233	2,510	545	21,830
Excess of revenue over expenses before translation effect	785	—	—	41	826
Translation effect for the year (Note 3)	(650)	—	—	—	(650)
Net excess of revenue over expenses	135	—	—	41	176

Status of Accounts: Donors Receivable and (Payments in Advance)

As of December 31, 1982

Exhibit 2

Currency: Thousands of U.S. Dlls.

Canadian International Development Agency	358
International Agricultural Development Service	28
International Crops Research Institute for the Semi-Arid Tropics	105
International Institute of Tropical Agriculture	27
Norwegian Agency for International Development	30
OPEC Fund for International Development	294
Spain, Government of	100
United Nations Development Programme	132
United States Agency for International Development	207
Other Donors	26
<hr/>	
Sub-Total: Accounts Receivable – Donors	1,307
Switzerland, Government of	(123)
The Ford Foundation	(75)
The Rockefeller Foundation/UNDP	(16)
<hr/>	
Sub-Total: Payments in Advance – Donors	(214)
<hr/>	
Net status of donor payments	1,093
<hr/>	

Detail of Sources of Income from Grants

For the Year Ended December 31, 1982

Exhibit 3

Currency: Thousands of U.S. Dlls.

Core Unrestricted Grants

Australia, Government of	373	
Canadian International Development Agency	1,229	
Denmark, Government of	252	
Germany, The Federal Republic of	740	
Inter-American Development Bank	3,649	
India, Government of	46	
Philippines, Government of	100	
Spain, Government of	200	
The Ford Foundation	75	
The Rockefeller Foundation	300	
The United Kingdom	568	
United States Agency for International Development	6,550	14,082

Core Restricted

France, Government of	158	
Japan, Government of	900	
OPEC Fund for International Development	740	
Switzerland, Government of	545	
The Netherlands, Government of	337	
United Nations Development Programme	1,553	4,233

Extra Core and Cooperative Projects

Banco de México, FIRA	15	
Canadian International Development Agency	885	
Food and Agricultural Organization	5	
Germany, The Federal Republic of	87	
International Agricultural Development Service	28	
International Crops Research Institute for the Semi-Arid Tropics	155	
International Institute of Tropical Agriculture	57	
Instituto Nacional de Investigaciones Agrícolas-INIA México	3	
Japan, Government of	4	
Kansas State University/NASA	60	
Norwegian Agency for International Development	30	
The Rockefeller Foundation	47	
The Ford Foundation	208	
United States Agency for International Development	577	
United Nations Development Programme	282	
Training Other Countries	67	2,510

Total income from grants		20,825
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Core-Restricted Pledges and Expenses

For the Year Ended December 31, 1982

Exhibit 4

Currency: Thousands of U.S. Dlls.

	Grant Period (1) (mo/day/yr)	Expenses		Total	Balance to be Expended (1)
		Cumulative	This Year		
Government of France					
Collaborative Research—Maize	1/1/82—12/31/82		86	86	
Bread Wheat	1/1/82—12/31/82	N/A	35	35	
Triticale	1/1/82—12/31/82		37	37	
Economics Consultancy					
Total			158 ⁽²⁾	158	
Government of Japan					
Wheat and Maize Plant Protection	1/1/82—12/31/82		664	664	
Wheat Southern Cone	1/1/82—12/31/82	N/A	236	236	
Total			900	900	
OPEC Fund for International Development					
Wheat-South and Southeast Asia	1/1/82—12/31/82		265	265	
Maize-East and West Africa	1/1/82—12/31/82	N/A	475	475	
Total			740	740	
Government of Switzerland					
Central America and Caribbean—Maize	1/1/79—12/31/81	1,226	56	1,282	93
Central America and Caribbean—Maize	1/1/82—12/31/84	N/A	345	345	
Central America and Caribbean—Economics	1/1/82—12/31/84	N/A	144	144	
Sub-Total Central America and Caribbean		N/A	489	489	1,527
Total		1,226	545	1,771	1,620
Government of the Netherlands					
Wheat Diseases Surveillance					
Turkey	9/1/79—12/31/82	466	238	704	
Egypt/Thailand	9/1/79—12/31/82	585	99	684	
Total		1,051	337	1,388	
United Nations Development Programme					
Nutritional Quality Maize — Phase IV	4/1/79—3/31/84	2,955	1,553	4,508	1,878
Total Core-Restricted		5,232	4,233	9,465	3,498

(1) For information purposes only

(2) Equivalent to French Francs 1,100,000

N/A = not applicable

(-) indicates zero or insignificant amount

Extra-Core Pledges and Expenses

For the Period January 1 to December 31, 1982

Exhibit 5

Currency: Thousands of U.S. Dlls.

	Grant Period (1)	Grant Pledged (1)	Cumulative	Expenses		Balance to be Expended (1)
				This Year	Total	
The Ford Foundation						
Economics and Training Algeria	9/1/79 – 8/31/83	480	310	145	455	25
Economics Training East Africa	9/24/81 – 9/30/83	126		63	63	63
Total Ford Foundation			310	208	518	
United States Agency for International Development						
Pakistan/Agricultural Research Council						
Wheat – Dollars	4/1/76 – 12/31/83	716	324	166	490	226
Maize – Dollars	4/1/76 – 12/31/83	704	335	124	459	245
Wheat – Rupees	4/1/76 – 12/31/83	564 (3)	218	95	313	251
Maize – Rupees	4/1/76 – 12/31/83	627 (4)	265	73	338	289
Equipment	4/1/76 – 12/31/83	261	241	–	241	20
Tanzania Maize	10/1/82 – 9/30/83	249		46	46	203
Zaire (North Shaba) – Maize	3/1/77 – 12/31/81	376	331	13	344	32
Maize Training		(2)		11	11	
Economics Africa	6/1/82 – 6/30/84	1,213		49	49	1,164
Total U.S.A.I.D.			1,714	577	2,291	
United Nations Development Programme						
Economics Policy Seminar	1/1/79 – 6/30/84	700	320	43	363	337
Wheat Training	11/1/79 – 5/31/82	140	60	18	78	62
Tropical Wheat Phase I and II	6/1/81 – 6/30/87	2,540	28	221	249	2,291
Total U.N.D.P.			408	282	690	

(1) For information purposes only

(2) Grant Period not applicable. Donor pays tuition for each trainee sponsored

(3) Equivalent to 5,644,887 rupees

(4) Equivalent to 6,268,288 rupees

(5) Equivalent to Canadian Dollars 338,944

(6) Equivalent to Canadian Dollars 450,000

(7) Equivalent to Canadian Dollars 4,680,000

Exhibit 5 (cont'd)

Currency: Thousands of U.S. Dlls.

	Grant Period (1)	Grant		Expenses		Balance to be Expended (1)
		Pledged (1)	Cumulative	This Year	Total	
Canadian International Development Agency						
Triticale Research and Training	4/1/78 – 12/31/80	286 (5)	230	10	240	46
India – Wheat and Maize	1/1/79 – 12/31/82	380 (6)	128	252	380	–
Ghana – Maize	1/1/79 – 12/31/82	588	431	157	588	–
Bangladesh – Wheat	4/1/82 – 4/30/87	3,790 (7)	–	400	400	3,390
Training Wheat:						
Peru, Peru/Puno		(2)	–	28	28	
Tanzania		(2)	9	23	32	
Associate Expert – Statistics	2/19/82 – 12/31/83	40		15	15	25
Total C.I.D.A.			798	885	1,683	
The Rockefeller Foundation/United Nations Development Programme/Australia (ADAB)						
Diseases Manual	1/1/82 – 7/31/82	63	–	47	47	16

(1) For information purposes only

(2) Grant Period not applicable. Donor pays tuition for each trainee sponsored

(3) Equivalent to 5,644,887 rupees

(4) Equivalent to 6,268,288 rupees

(5) Equivalent to Canadian Dollars 338,944

(6) Equivalent to Canadian Dollars 450,000

(7) Equivalent to Canadian Dollars 4,680,000

Exhibit 5 (cont'd)

Currency: Thousands of U.S. Dlls.

	Grant Period (1)	Grant		Expenses		Balance to be Expended (1)
		Pledged (1)	Cumulative	This Year	Total	
Training Grants						
Banco de Mexico, FIRA		(2)	—	15	15	
BADC, Netherlands		(2)	6	1	7	
British Council		(2)	—	7	7	
Food and Agricultural Organization		(2)	—	5	5	
Government of Argentina, INTA		(2)	13	1	14	
Government of Dominican Republic, ISA		(2)	—	8	8	
Government of Nigeria		(2)	—	7	7	
Government of Spain		(2)	—	3	3	
International Crops Research Institute for the Semi-Arid Tropics		(2)	—	12	12	
Inter-American Development Bank		(2)	—	17	17	
Kansas State University/NASA		60	—	60	60	—
Norwegian Agency for International Development	1/1/82 — 12/31/82	65		30	30	35
Overseas Development Administration				1	1	
UNIPAN/BID-Panama		(2)	—	7	7	
World Bank		(2)	—	5	5	
Data Processing						
International Development Research Centre	11/15/82 — 11/30/84	145		10	10	135
Government of Federal Republic of Germany	1/1/81 — 12/31/82	87		87	87	—
			3,249	2,275	5,524	

(1) For information purposes only

(2) Grant Period not applicable. Donor pays tuition for each trainee sponsored

Cooperative Projects' Pledges and Expenses

For the Period January 1 to December 31, 1982

Exhibit 6

Currency: Thousands of U.S. Dlls.

	Grant Grant Period (1)	Grant Pledged (1)	Expenses			Balance to be Expended (1)
			Cumulative	This Year	Total	
Government of Japan						
Maize Visiting Scientists		(2)	--	4	4	
Instituto Nacional de Investigaciones Agrícolas -- México						
Potato		(2)	--	3	3	
International Agricultural Development Service						
Nepal -- Wheat and Maize Training		(2)	97	28	125	
International Crops Research Institute for the Semi-Arid Tropics/IDRC						
Maize -- Sorghum, Phase IV	1/1/81 -- 12/31/84	817	115	143	258	559
International Institute of Tropical Agriculture						
Tanzania -- Maize	11/1/76 -- 9/1/81	--	457	57	514	
Total Cooperative Projects			669	235	904	

(1) For information purposes only

(2) Grant Period not applicable. Donor pays tuition for each trainee sponsored.

This section highlights some of the significant financial trends that have helped to shape CIMMYT's activities and achievements over the past five years (1978-1982). Its purpose is to both complement and provide perspective to the independently audited financial statement presented for 1982.

Any financial statement, by its very nature, is constrained by its structure, particularly with respect to time. A statement of condition (balance sheet), for example, can only provide a "snapshot" view of the institution on the last day of the accounting year, while a statement of activity (income statement) goes only a bit further to describe revenues and expenses during the year. This section seeks to extend that time frame and provide depth of analysis by selecting significant items from the financial statement and biennial budget submitted to the CGIAR and comparing them over the past five years.

The data are grouped under three headings:

- levels of funding
- distribution of resources
- financial indicators

Although this is not an exhaustive analysis of trends we do feel that the information presented here portrays the events that have influenced CIMMYT's ability to fulfill its mission of improving maize and wheat production throughout the world.

Levels of Funding

One measure of the strength of a non-profit institution such as CIMMYT is its ability to attract funding. For CIMMYT this has generally meant donations to core programs from members of the CGIAR. In recent years these have amounted to over 95 percent of total core revenues.

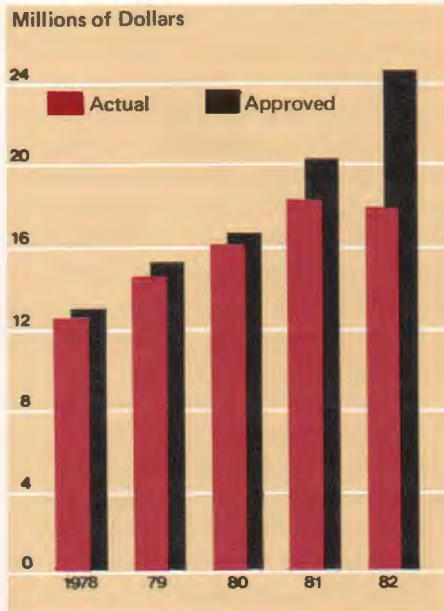
In the past five years two types of statistics on funding have been important to CIMMYT:

1) **Approved vs Actual.** In recent years the gap has been increasing between funding approved by the CGIAR and funds actually received. The shortfall in funds has generally resulted in a reduction in planned activities.

2) **Nominal and Real Levels of Funding.** Since 1978 inflation and exchange rates, mainly in Mexico, have eroded the nominal value of funds received from the CGIAR. This is due principally to the fact that CIMMYT's sources of funding are largely external, i.e., other than Mexican-based, and this has had an important effect on levels of operations and manpower since 1978.

In 1978, actual funding represented 98 percent of approved funding, but by 1981 this figure had dropped to 90 percent, and by 1982 to 73 percent. This latter figure is distorted somewhat by the devaluation of the Mexican peso, which reduced the dollar value of CIMMYT's spending in pesos and, therefore, created an artificially large gap in funding.

**Core Operating Budgets:
Actual Vs Approved**

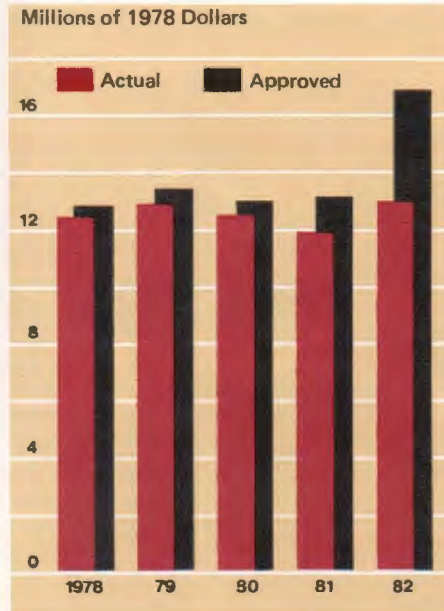


Even without this, though, CIMMYT's actual funding would most likely have represented only 85 percent of its approved budget.

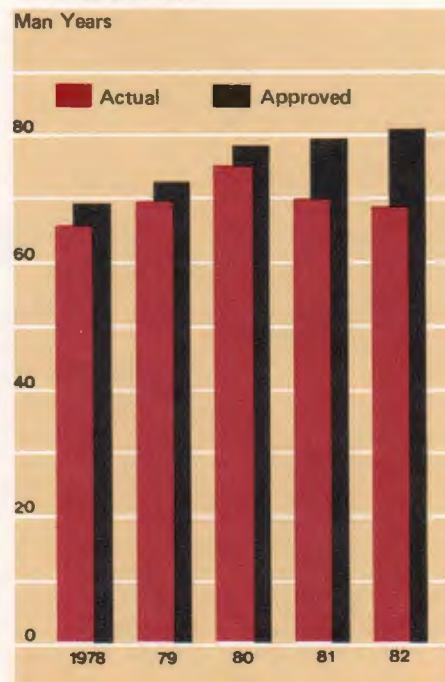
In real terms, actual funding has changed little since 1978. Figures for 1982 (\$ 13.0 million) show only a small increase over 1978 (\$12.6 million). This too is colored by the devaluation of the peso; without it 1982 funding would have been closer to 11.2 million, or 12 percent below the 1978 level.

The effect of this funding pattern is shown in international staff man years in the table below. Between 1978 and 1982, this staff category (which includes scientists and senior administrative personnel) grew by 7 percent, or just over 1 percent per year. In fact in three of those five years, staffing was at or near the 69.0 man year level. Similarly the gap between approved and actual levels grew from 4 percent in 1978 to 13 percent in 1982.

**Core Operating Budgets:
Actual Vs Approved**



International Staff



It would be incorrect to interpret from these data a lack of support of CIMMYT from donors; in fact nominal funding grew at almost 15 percent per year, well above the rates of inflation in any of the donor countries. Instead a rather different conclusion emerges that affects not only CIMMYT but perhaps all of the CGIAR system. The source of CIMMYT's financing is largely external, i.e., revenues originate outside the countries of operation. Thus, while budgets and plans are based mainly on conditions in Mexico, revenue decisions are made using a different set of criteria. This potential for gaps between revenues and needs is exacerbated when one country's inflation and exchange rates are markedly different from others.

This condition becomes a particularly serious problem with an inflexible planning framework such as that currently used by the CGIAR where needs, and hence revenues, are projected two to three years in advance and there are only limited mechanisms for adjustment as economic conditions within the host country or other countries of operation change. The result is often a gap between approved and actual funding and, more importantly, changes in the real value of funds.

Distribution of Resources

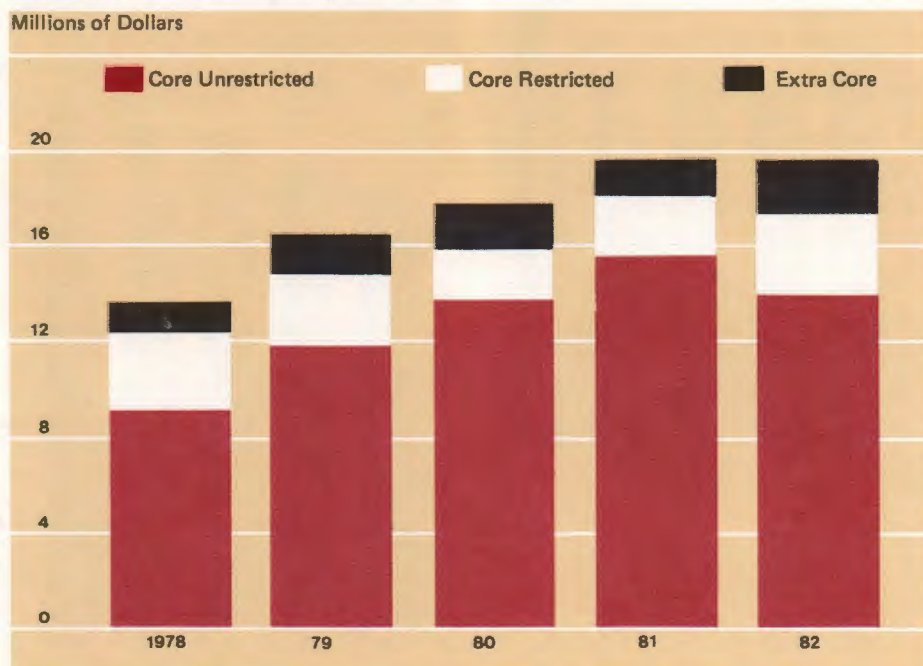
In recent years, the questions of core-unrestricted vs core-restricted funds, and core vs extra-core have become important. In the former case, core-restricted funds reduce the financial planning and management flexibility of the Center. Also, because they require additional accounting and reporting, core-restricted funds generate additional administrative workloads. Similarly, extra-core funds may siphon funds away from core funding and, thus, may weaken the CGIAR system for making financial pledges.

Throughout the past five years the distribution of funds at CIMMYT has been variable. Core-unrestricted funds have ranged from 79 percent of total to 67 percent, core-restricted from 24 percent to 18 percent and extra-core 11 percent to 8 percent.

During this period, CIMMYT has deliberately limited the growth of its extra-core funds, with most growth coming from additional training activities. Core-restricted funds have also shown some variation but, of perhaps greater importance in 1982, 50 percent of regional program activity is now funded under such arrangements while only 12 percent of headquarters based work is funded this way. This has resulted in a high degree of inflexibility in CIMMYT's resource planning and deployment process.

The devaluation of the peso has also had an effect on the distribution of resources since so many unrestricted funds have been directed toward headquarters activities. This has tended to overstate the percentage of core-unrestricted compared to total and understate all others. This accounts, at least partly, for the decline in core-unrestricted pledges in 1982 relative to other sources of funding.

Funding Patterns Distribution of Operating Programs



Financial Indicators

Measurement of the financial strength of a non-profit institution such as CIMMYT is a difficult undertaking. The standard financial ratios, such as measurement of net income and return on investment, are all difficult to apply. Nonetheless, CIMMYT management has selected three financial indicators that it feels describe objectively changes in the institute's financial condition over time.

These are:

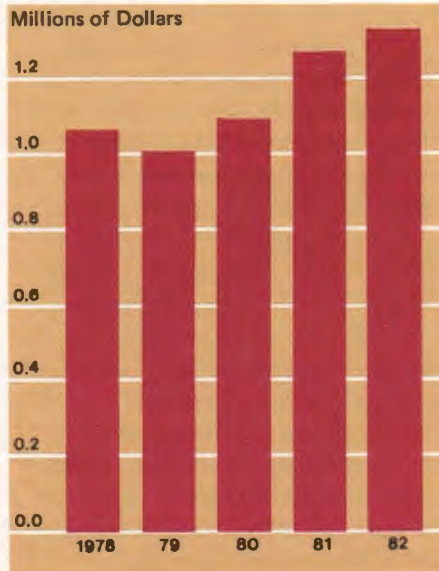
Fund Balances. Which represent the net worth of the institution.

Accounts Receivable. In an institution such as CIMMYT that is dependent on annual donations, excessive accounts receivable tie up cash and thereby constrain program activities. An additional burden can be created by cost-reimbursable funding. These grants, which can only be paid after the activity has taken place, tend to inflate donor receivables.

Increase (Decrease) in Working Capital. This statistic shows the internal financing capabilities of the institute. In general an increase in working capital from one year to the next gives flexibility to the institute in providing temporary short-term self financing for its activities. In an institute such as CIMMYT, with a steady outflow and a variable inflow of cash, this is an important statistic.

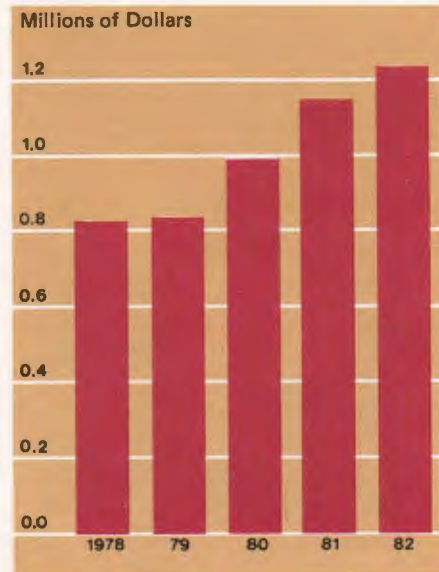
These are described in greater detail in the following graphs.

Fund Balances

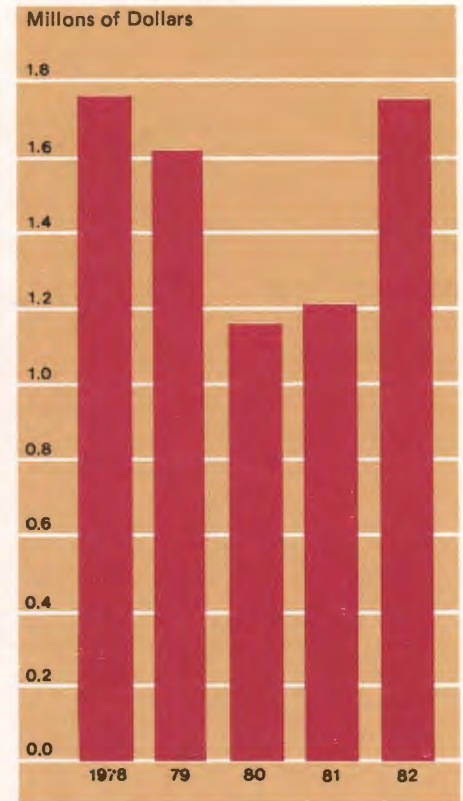


Since 1978, fund balances have grown almost 30 percent or just over 5 percent per year. The largest component of fund balances, paid-up capital, has shown an even greater growth, almost 50 percent over the period or 8 percent per annum. This is due primarily to a revaluation of capital items in 1980 in accordance with CGIAR policies (see also Note 2 of the Financial Statement), and several significant additions to capital between 1980 and 1982, including a dormitory for visiting scientists, a wheat germplasm bank, and new computing facilities. These together contributed close to \$2.0 million in capital.

Capital

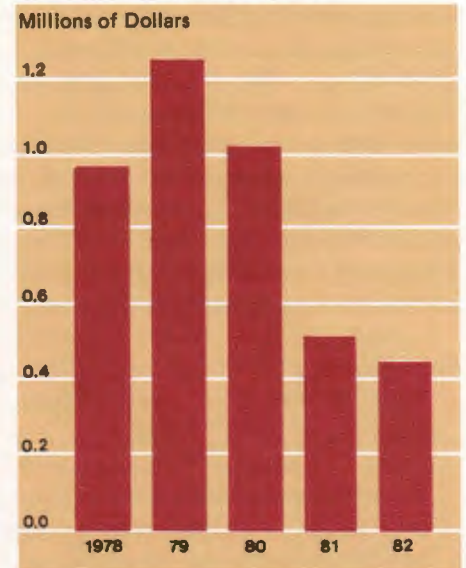


Accounts Receivable

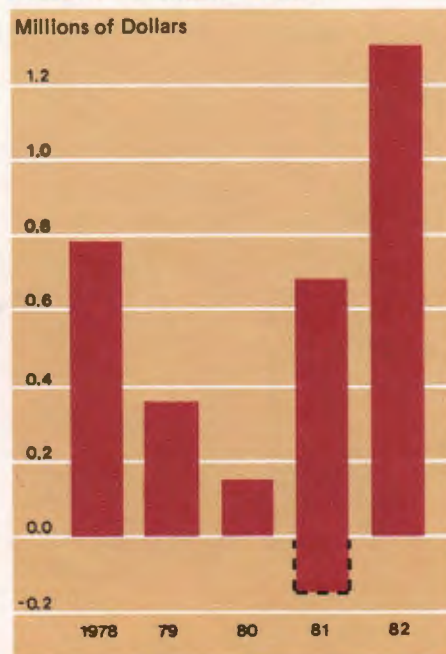


Accounts receivable in 1982 are approximately equivalent to their 1978 level. At their lowest point, in 1980, they were 34 percent below the 1978 level. The increase in recent years is attributable to donor receivables, as some important grants are on a cost-reimbursable basis. Part of the increase is also due to a change in the reporting format. Prior to 1981, donor receivables were reported on a net payment basis, i.e., payments in advance were subtracted from receivables. Since 1981, however, payments in advance have been treated as liabilities and not netted against donor receivables. The dotted line on the donor receivables graph shows the year-end levels with payments in advance netted against donor receivables.

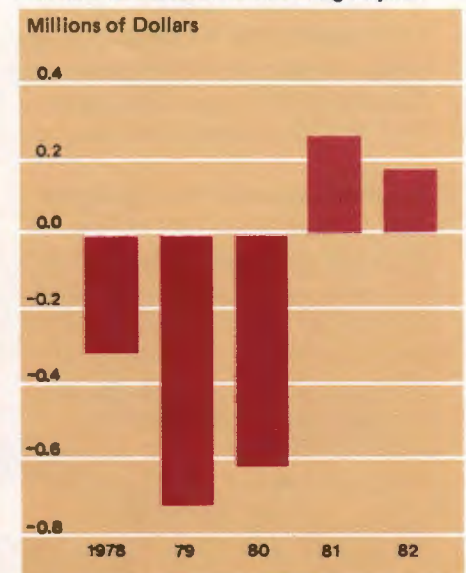
Accounts Receivable: Others



Accounts Receivable: Donors



Increase (Decrease) in Working Capital



Between 1978 and 1980, CIMMYT drew down on its working capital (current assets—current liabilities) to provide financing for its on-going programs. This was due to a combination of factors, among them a generally difficult cash flow situation and dollar revenues that were eroded by high inflation in Mexico and an overvalued peso. Since 1981, however, the institute's working capital position has improved, mainly due to better cash management and a much improved cash flow. The decline in 1982 is partly the result of the devaluation of the peso, which required write-downs of assets.

Summary

There is no quick and easy way to sum up the period 1978 to 1982 for CIMMYT. Certainly, these were difficult years, marked by funding shortfalls which required significant financial and staffing adjustments. In 1978, CIMMYT was a \$12.6 million dollar institution with 66 international staff on core programs. In 1982, it was a \$17.8 million dollar institution with 68 international staff. Though this represented a significant growth in nominal terms, real levels of funding changed only slightly. In contrast, CIMMYT's financial condition in 1982 was improved over 1978. Fund balances were up by over \$3.0 million, accounts receivable were improved and working capital increased. Whether this was the result of the financial stringencies imposed by the period is a matter of conjecture. Perhaps a tentative conclusion for the past five years is that the Center's financial difficulties prompted some healthy critical program reviews that resulted in greater efficiencies in overall program operations.

Looking to the future, CIMMYT's long-range plan remains the ultimately desirable goal for the institution. This would mean 98 international staff by the end of the decade at the latest and, therefore, real increases in funding and manpower in each of the coming years. It is our belief that these manpower and budgetary expansions are vital to sustain the research progress that has characterized CIMMYT's history and to redress the temporary disinvestments in human and physical capital that unfortunately marked the period 1978-1982.

Extra-Core Grants

Extra-Core programs are generally of four types:

- 1) Direct assistance (posting of staff or provision of research equipment) to national 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 have 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 in an experience concept and/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.
- 5) It should not imply a continuing core obligation for CIMMYT, e.g., all potential staff repatriation, rehabilitation or ancillary costs on termination must be funded by the donor.

In 1982, total extra-core grants amounted to US\$2,510,000 or 13 percent of core expenditures. These funds supported a variety of projects; individual reports on twelve major grants are included in the following pages.

Project:	Ghana Maize Program
Donor:	Canadian International Development Agency (CIDA)
Pledge:	US\$ 753,581
Duration:	January 1979-December 1983

Financial Summary

Expenses	
Previous Years	US\$ 431,000
1982	US\$ 157,000
Total to date	US\$ 588,000

Balance Available	US\$ 265,581
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Objectives

The overall objective of the project is to increase maize production in Ghana by developing superior maize production technology and upgrading research and production staff already involved in the current maize research programme conducted by the Crops Research Institute. The project also calls for research on cowpeas, in coordination with the International Institute of Tropical Agriculture (IITA).

Staffing

The project calls for the assignment of one project director, located in Mexico, and one joint coordinator posted in Ghana. The director of the maize program currently serves as project director at no cost to the project.

Project Description

Two types of activities are carried out under the grant:

- 1) Breeding which seeks to allow the development of high-yielding varieties adapted to the various ecological zones and crop uses in Ghana. This is to be accomplished through:
 - a) increased grain yield and yield stability,
 - b) improved resistance to lodging,
 - c) the development of specific maize varieties for the first and second plantings, and
 - d) improved disease and insect resistance.
- 2) On-farm research and demonstrations that are complementary to the breeding program and work at developing:
 - a) suitable agronomic practices for the various ecological zones of Ghana,
 - b) cropping systems which will include maize,
 - c) appropriate technology to aid the small scale farmer, and
 - d) extension information.

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 1982

During 1982, population improvement was continued in the five maturity and grain type classes that have been identified as meeting the maize varietal needs of Ghana. Progeny and variety trials were conducted at experiment stations located in the coastal savannah, forest transection, and Guinea savannah zones. For the first time a project maize breeder was stationed in the Guinea savannah to complement the breeding program based in the forest zone. Breeders' seed of improved versions of released varieties were given to the Ghana Seed Company, and recommendations for the release of three varieties in 1983 was made.

A total of 195 on-farm agronomy trials and 265 verification/demonstration plots in maize were planted throughout Ghana in 1982. Useful data were returned from 76 percent of the research trials and from 85 percent of demonstrations. Trials examined the effects of variety, tillage, herbicides, soil supplementation by zinc, methods and times of application of fertilizer, variety by plant density interactions, and the relationships between maize, cowpea and cassava in intercropping situations. Based on trial results, updated maize production recommendations were released for the 1983 crop season.

Project staff were involved in preparation of a National Maize Production Plan for Ghana in October 1982 at the request of the Secretary of Agriculture. The plan has been adopted in principle.

Similar activities, but smaller in scale, were undertaken with cowpeas. Varietal testing of Ghanaian and IITA cowpea varieties was carried out on station and complemented by 26 on-farm varietal trials. Cowpea demonstrations were carried out on 40 sites throughout Ghana.

Maize

Project: Pakistan Maize Program

Donor: United States Agency
for International
Development (USAID)

Pledge: US\$ 704,000
RPS 6,268,288
US\$ 1,226,000 (est.
Total)

Duration: April 1976-December
1983

Financial Summary

Expenses

Previous Years	US\$ 600,000
1982	US\$ 197,000
Total to date	US\$ 797,000

Balance Available US\$ 429,000

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 calls for 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 provincial research centers as well as appropriate extension personnel as desired by the PARC with their respective on-going maize programs giving major emphasis to:

- 1) develop short-season varieties for rainfed areas of maize production through the introduction of new strains and breeding,
- 2) increase the protein quality content of commercial varieties,
- 3) identify the cause of leaf blight and stalk rot, and broaden maize research to include more pathology research, and
- 4) expand breeders seed production programs. Work closely with research and extension staff to test experimental varieties under farm conditions. 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 1982

During 1982 work continued on the development of two short-season maize varieties. The populations are called NARC Pool 10 and NARC Pool 20. Training received major emphasis: a pathology course was arranged in Pakistan related to stalk rot, four Pakistani scientists received in-service training in Mexico and two in-country courses were conducted. In total, over 50 Pakistani scientists received training under the grant.

The staff member was also involved in breeder seed programs and on-farm trials of this seed were initiated in the Islamabad district.

Maize

Project:	Tanzania Maize Program
Donor:	United States Agency for International Development (USAID)
Pledge:	US\$ 248,975
Duration:	October 1982-September 1983

Financial Summary

Expenses	
Previous Years	N/A
1982	US\$ 46,000
Total to date	US\$ 46,000
Balance Available	US\$ 202,975

Objectives

The CIMMYT maize program has had staff posted in Tanzania, under a variety of funding arrangements, since 1973. The objectives of the current project are to provide continuity to the nation's on-going maize research and land development activities.

Staffing

The project calls for two CIMMYT staff to be posted to Tanzania, one a breeder/agronomist and the other an agricultural engineer.

Project Description

The principal tasks of the breeder/agronomist are to serve as joint coordinator of the national maize research program and to advise and assist his Tanzanian counterpart in assuming that role upon his departure. The breeder/agronomist also works with AID-funded economists to conduct an evaluation of existing research results for maize with emphasis on the southern highlands. The purpose of this analysis is to develop farm-level management recommendations for maize production.

These recommendations will cover:

- 1) planting densities,
- 2) fertilization,
- 3) weed management, and
- 4) varietal selection.

The agricultural engineer is mainly engaged in supervising and training the Tanzanian staff of TARO-Ilonga in implementing a master land use plan. This includes the development of irrigation systems, fencing, land preparation, repair and servicing of appropriate equipment and training of staff.

This is mainly a bridging contract designed to sustain the maize research program in Tanzania until a larger program (also USAID-funded) in farming systems research can get under way. As such, this can be considered an institutional project mainly benefitting the national maize research program.

Activities in 1982

During 1982 the CIMMYT breeder/agronomist was involved in several aspects of maize research in Tanzania. Approximately 160 trials sets were prepared and distributed to maize staff in Tanzania. Also, data analysis was continued on the 1981/82 maize research trials and a progress report was presented to the national maize research committee. Planning for the 1983/84 cycle was initiated and a draft budget was submitted.

The agricultural engineer was also active in the project. Initial land leveling was completed on 26 hectares, 1,200 meters of boundary road and 1,000 meters of boundary fencing were built and 30 hectares of land were prepared for maize trials.

Project:	Bangladesh Wheat Program
Donor:	Canadian International Development Agency (CIDA)
Pledge:	C\$ 4,456,000 US\$ 3,610,000 (est.)
Duration:	April 1982-March 1987

Financial Summary

Expenses

Previous Years	N/A
1982	US\$ 400,000
Total to date	US\$ 400,000
Balance Available	US\$ 3,210,000

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 upgrade 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 is designated the joint coordinator for the program. A second person is expected to take up residence in August of 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 early-maturing varieties, tolerance to heat stress and improved resistance to several important foliar diseases.

Activities in 1982

The first CIMMYT staff member took up residence in Bangladesh in June of 1982. Since that time he has been active in all areas of the project. In conjunction

with BARI staff, he has reviewed the wheat breeding program and several new research programs have been launched in the areas of the development of early maturing varieties, selection of lines for both dryland and irrigated conditions, establishment of an *Helminthosporium* screening nursery to develop varieties with greater resistance, testing for salt tolerance, and rice/wheat cropping systems. Soil nutrient deficiencies have been noted in several areas. This will require the attention of the CIMMYT agronomist scheduled to join the project in 1983.

One factor that will permit the implementation of this program is that wheat research at BARI has for some time been carried out in an advanced and highly effective way. Eleven varieties have been released in as many years. The review of the breeding program by the BARI staff and the CIMMYT Joint Coordinator is an attempt to sustain this very high level of achievement. As part of this review all the major wheat-growing areas of Bangladesh were visited in 1982.

Training activities have proceeded on schedule with several Ph.D and MSc candidates identified. One of these is expected to begin a doctoral program in wheat breeding in the spring of 1983.

With respect to equipment, close to half of the authorized budget was committed in 1982, with delivery scheduled in 1983. The critical equipment needs are for harvesting, seed storage, transportation and laboratories. Delivery of this equipment and its use will provide a big boost to the wheat research efforts in Bangladesh. More equipment and supplies will be ordered in 1983.

Project:	Pakistan Wheat Program
Donor:	United States Agency for International Development (USAID)
Pledge:	US\$ 716,000 RPS. 5,644,887 US\$ 1,280,000 (est.)
Duration:	April 1976-December 1983

Financial Summary

Expenses	
Previous Years	US\$ 542,000
1982	US\$ 261,000
Total to date	US\$ 803,000
Balance Available	US\$ 477,000

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 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 program,
- 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. 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 1982

Two new varieties were released in 1982. In addition, approximately 60 nurseries were sent by CIMMYT to the several Pakistani breeding programs. This was the largest number of nurseries sent to any country by the Wheat Program.

A series of uniform weed control trials was carried out at several stations with the collaboration of Pakistani scientists. These trials were to determine the amount of damage from weeds, and to test several herbicides for effectiveness and assess the economic potential of this technology.

Trials to study improved tillage and cultural practices for soil management and water conservation were started at the National Agricultural Research Center (NARC).

A three week weed control training course was carried out in cooperation with the International Plant Protection Center of Oregon State University. About 26 trainees participated. Three other Pakistani scientists also participated in CIMMYT in-service training programs in Mexico.

Wheat

Project: Wheat for the Warmer Sub-tropical Areas

Donor: United Nations Development Programme (UNDP)

Pledge: US\$ 2,415,000

Duration: April 1982-March 1987

Financial Summary

Expenses

Previous Years	N/A
1982	US\$ 124,350
Total to date	US\$ 124,350

Balance Available US\$2,290,650

Objectives

The overall goal of the project is to develop high-yielding, disease-resistant semidwarf wheats that will perform at economically profitable levels in the cooler seasons in warmer tropical and subtropical environments of the world.

Staffing

The project calls for two scientists, one located in Mexico and one posted outside Mexico to initiate shuttle breeding cycles. This latter person will begin activities in the second year of the project. In addition, the associate director of the CIMMYT wheat program acts as the project coordinator. His costs are not charged to the project.

Within this overall context, specific research objectives are to develop wheat germplasm with the following agronomic and industrial characteristics:

- 1) wide adaptation with high yield potential,
- 2) photoperiod insensitivity,
- 3) tolerance to heat (in both juvenile and later growth stages),
- 4) high tillering ability,
- 5) varying maturity characteristics to fit different environments with emphasis on early types,
- 6) semidwarf stature to withstand lodging,
- 7) acceptable milling and baking quality to meet local requirements.

Work in disease resistance will concentrate on leaf rust, *Helminthosporium*, *Fusarium* and leaf blight.

It should also be noted that the various areas served by the project will have different agronomic and disease constraints, such that research priorities will vary accordingly. Areas that are expected to benefit from this research are mainly located between 0° and 20° latitude, north and south, and from 0 to 1,000 meters in elevation. This includes hot dry climates and subtropical areas with greater humidity.

Project Description

Project activities are carried out in four ways:

- 1) **Shuttle breeding.** Three kinds of shuttle breeding approaches involving the growing of alternate breeding cycles are planned for this project.

Selection of scab-resistant lines will be done in Mexico (Toluca and CIANO, Ciudad Obregon stations) and Argentina; *Helminthosporium* and leaf rust resistance, earliness, and heat tolerance will be sought in a Mexico/Bangladesh shuttle; and finally selection for *Helminthosporium sativum* resistance will be done between Mexico and Brazil.

- 2) **International testing.** Three specialized screening nurseries will be distributed on request to cooperators in interested countries.

- 3) **Training and conferences.** Approximately thirty percent of direct costs will be devoted to these activities.

- 4) **Equipment.** Funds for pathology, crossing and harvesting equipment, and seed cleaners are provided.

Activities in 1982

Activities in 1982 were carried on from preliminary investigations done in 1981. Segregating populations were identified from crosses in 1982 and classified according to their characters as F₂ Scab, F₂ Helminthosporium and F₂ Spring x Winter, and shuttled to different places around the World. Based on lines identified by CIMMYT and collaborators in national programs, two nurseries were developed, one on *Helminthosporium* and the other on heat tolerance. These have been distributed to 60 collaborators in total and results are expected back in 1983.

Project: On-Farm Research in Eastern and Southern Africa

Donor: United States Agency for International Development (USAID)

Pledge: US\$ 1,213,000

Duration: July 1982-June 1984

Financial Summary

Expenses	
Previous Years	N/A
1982	US\$ 49,000
Total to date	US\$ 49,000
Balance Available	US\$1,164,000

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 will concentrate on four major objectives:

- 1) on-farm research,
- 2) training,
- 3) network development, and
- 4) institutionalizing the on-farm research concept.

Staffing

Two CIMMYT economists are assigned to the project. One is responsible for collaborating with USAID-sponsored teams in Lesotho, Botswana, Swaziland and Malawi. The second concentrates on training in the region as well as collaborating with USAID programs now being negotiated.

Project Description

Major activities include:

- 1) **Regional Seminars and Publications.** The aim here is to facilitate discussion and exchange among the various programs so that the accumulating experience can be shared.
- 2) **Training.** The project proposes to implement a series of four in-country training programs using a format recently introduced by the CIMMYT economics group. 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 involving farm-level surveys and ending with on-farm research trials and technology demonstrations.
- 3) **Direct Cooperation with National Programs.** At the request of these programs and their USAID collaborators, the CIMMYT staff will participate in adaptive on-farm research surveys to assess farmer circumstances, evaluation of possible new technological components to enhance farmer productivity, and on-farm trials.
- 4) **Development of Research Results Relevant to Policy Formulation.** 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 will be 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 will also benefit from the knowledge acquired and seek to transfer these lessons to other areas of the world.

Activities in 1982

Two CIMMYT economists were contracted to work under this grant. They spent three months each in Mexico at CIMMYT's headquarters familiarizing themselves with CIMMYT's overall research program. Later in the year they took up post in Africa. Since then, they have participated in training courses in Zambia and Zimbabwe, and established collaborative links with national programs in the region.

Project:	Algerian Graduate Training Fellowships
Donor:	Ford Foundation
Pledge:	US\$ 670,350
Duration:	September 1979–August 1985

Financial Summary

Expenses	
Previous Years	US\$310,000
1982	US\$145,000
Total to date	US\$455,000
Balance Available	US\$225,000

Objectives

The project seeks to facilitate institution building within the Algerian Institute de Developpement des Grandes Cultures (IDGC) through the provision of graduate training in a number of disciplines.

Staffing

No CIMMYT staff are currently assigned to the project. Administrative support is provided by CIMMYT's personnel and finance departments, and the regional wheat team for North and West Africa stationed in Portugal.

Project Description

The project provides graduate training at universities in France and the USA. Disciplines include agricultural economics, soils, seed production, agronomy and plant breeding.

CIMMYT's involvement with the Algerian national research program dates to the early 1970s when CIMMYT had up to four people posted in Algeria. The current grant is in fact a continuation, in part, of the original program. Activities carried out in this training phase will help to strengthen the linkages between the national program and CIMMYT's North and West Africa regional wheat program.

Activities in 1982

During 1982 the following students were enrolled in graduate level courses:

Name	Degree	University	Expected Graduation
Aomar Ait-Amer	M.Sc. Crop Science	Oregon State Univ.	Jan. 1983
Abderrazak Belaid	Ph.D. Agric. Economics	Oregon State Univ.	March 1985
Nadjib Benacef	M.Sc. Cereal Breeding	Oregon State Univ.	June 1982
Abdekader Benbelkacem	M.Sc. Plant Breeding	Univ. of Minnesota	Sep. 1982
Lakhdar Boukerrou	M.Sc. Agric. Economics	Univ. of Minnesota	Dec. 1983
Hamenna Bouzerzour	M.Sc. Agronomy	Univ. of Nebraska	Jan. 1984
Louchi Brinis	M.Sc. Seed Technology	Mississippi St. U.	Aug. 1982
Kamel Feliachi	3rd. Cycle Trg. Economics	Univ. of Dijon, France	Jan. 1983
Mohamed Maatoughi	M.Sc. Soils	Oregon State Univ.	Jan. 1983
Ali Zeghida	M.Sc. Agronomy	Oregon State Univ.	March 1982
Mohamed Zerkoune	M.Sc. Agronomy	Univ. of Nebraska	Aug. 1983

Training

Project:	Training in Farming Systems Research in Eastern and Southern Africa
Donor:	Ford Foundation
Pledge:	US\$ 126,500
Duration:	September 1982- August 1983

Financial Summary

Expenses			
Previous Years	US\$	3,000	
1982	US\$	63,000	
Total to date	US\$	66,000	
<hr/>			
Balance Available	US\$	60,500	

Objectives

The objective of this grant is to support training in on-farm research in eastern and southern Africa. It is supplemental funding for on-going activities in the area.

Staffing

No CIMMYT staff are funded under the project. The CIMMYT economist stationed in East Africa and headquarters' staff devote a portion of their time to this project.

Project Description

The project contains four components:

- 1) training in on-farm research,
- 2) workshops and seminars,
- 3) pilot exercise in farming systems research, and
- 4) networking in on-farm research.

The funds granted under this project permit augmentation of current training activities in eastern and southern Africa. As an institution-building project the direct beneficiaries are the national research programs in the region. In that sense the program is complementary to the core economics and crops research programs based in East Africa. On a more generalized level the activities carried out under the grant are part of the on-farm research and practice done currently in the CIMMYT economics program.

Activities in 1982

A number of activities took place in training in on-farm research. In Zambia, grant funds were used to assist an adaptive research planning team (ARPT), allowing supervision of ARPT pilot projects, on-the-job training of ARP teams, and production of training materials for team members. In Zimbabwe, a course in farming systems and on-farm research was developed in conjunction with the University of Zimbabwe, and in-service training was undertaken with the Ministry of Agriculture. This latter course will include both crop and livestock researchers.

One workshop was held in 1982 in Nairobi, entitled "The Planning, Organization, Management and Interpretation of Adaptive On-Farm Experiments." The workshop followed through the sequence of planning, organizing, managing and interpreting experiments on farmers' fields. Three farmer problems were identified from survey work in Zimbabwe, and were used as case studies for the course.

Funds were also committed for a pilot research program at the National Animal Husbandry Research Station at Nawasha, Kenya. Programs already mentioned at the University of Zimbabwe and that country's ministry of agriculture also included pilot research components.

The University of Zimbabwe will also host regional training workshops replacing the biannual meetings mounted by CIMMYT in Nairobi since 1979. This will assist the development of a network of those working at on-farm research in eastern and southern Africa.

Training

Project:	Policy Seminars
Donor:	United Nations Development Programme (UNDP)
Pledge:	US\$ 700,000
Duration:	July 1979-June 1984

Financial Summary

Expenses	
Previous Years	US\$320,000
1982	US\$ 43,000
Total to date	US\$363,000
Balance Available	US\$337,000

Objectives

The UNDP-sponsored policy seminars project began in 1979. Initially, the objectives were to produce case studies and sponsor seminars for policy makers in national agricultural research and production institutions. The project focused on the relationship between policy and agricultural research in the diffusion of agricultural technology. In the second phase of the project, which began in mid-1981, the focus shifted to the organization and administration of agricultural research. During the second year, cooperation with ISNAR was established and CIMMYT requested that ISNAR—with its special expertise in these areas—play the role of executing agency for the project.

Staffing

One staff member is assigned to this project.

Project Description

The current phase of the project calls for the preparation of eighteen case studies with ISNAR giving special emphasis to African research management issues. Some of the topics identified for study as they relate to national agricultural research organizations are:

- 1) identification of farmer clients and assessment of their needs,
 - 2) coordination of research and extension functions,
 - 3) management of agricultural research, and
 - 4) planning and review of programs.
- Funds for seminars and other presentations of these cases will come from other sources.

The intended direct beneficiaries of this project are policy makers and national research programs in target countries. The project also has a strong feedback to the CIMMYT Economics Program, especially with respect to on-farm research. The preparation of these case studies helps to highlight important issues in national research programs and thereby guide biological and social scientists in the transfer of technology.

Activities in 1982

During the year, five case studies were prepared:

1. The Management of Careers with a National Agricultural Research System (using Guyana as the setting)
2. The Establishment of Efficient Communications Procedures (Honduras)
3. The Setting of a Research Agenda (Nigeria)
4. Research/Extension Coordination (Guatemala)
5. The Establishment of an On-Farm Research Program (Ecuador)

Two related activities were carried out by ISNAR utilizing some of the experience and information from the project. One colloquium was held, cosponsored by the Economic Development Institute of the World Bank, on new directions for training in agricultural research management. Discussions focused on training research managers, the modes for doing so, and the suggested curriculum. A training seminar was held at IITA with approximately 60 IITA postgraduate fellows and senior scientists in attendance. The seminar provided an overview of planning and management issues within agricultural research.

Plans for 1983 include the preparation of six cases using the guidelines presented above. Additional funds will be sought for sponsorship of seminars. It is probable that a number of seminars will be held in Africa during the year.

Data Processing

Project:	Computing Systems
Donor:	International Development Research Centre (IDRC)
Pledge:	C\$ 188,900 US\$145,300 (est.)
Duration:	November 1982-October 1984

Financial Summary

Expenses	
Previous Years	N/A
1982	US\$ 10,000
Total to date	US\$ 49,000
Balance Available	US\$135,308

Objective

The primary objective of the project is to facilitate the transfer of software and systems technology, and statistical and biometrical procedures developed or refined in Canada to CIMMYT and other agricultural research organizations in the developing countries.

Staffing

One CIMMYT member, on loan from the government of Canada, is assigned to the project.

Project Description

The staff member assigned to this project assists in the operation and management of CIMMYT's computer (DEC VAX 11/780) and related software system. This includes training of personnel, systems management, collaboration with consultants and software evaluation and development.

The project is designed to enhance significantly CIMMYT's use of its newly acquired computing facilities. This in turn will permit greater interaction with national programs in the use and analysis of data. Short-term consultants in statistics/biometrics from Agriculture Canada are also provided under the project.

Activities in 1982

Since the initiation of the project the specialist has been active in a number of areas. Several software systems have been developed for use by a number of groups within CIMMYT, including, maize, wheat, economics, station management, communications and international testing. Also, programs have been written that will provide a number of advantages to the current operating system, making it more user-friendly and efficient. The staff member has also participated in the evaluation of additional computer equipment for the VAX 11/780, word processing equipment and software.

Data Processing

Project:	Associate Expert-Data Processing
Donor:	Canadian International Development Agency (CIDA)
Pledge:	C\$ 50,000 US\$40,000 (est.)
Duration:	February 1982-January, 1984

Financial Summary

Expenses	
Previous Years	N/A
1982	US\$15,000
Total to date	US\$15,000
Balance Available	US\$25,000

Objective

The project seeks to provide the critical programming and analytical support needed during the conversion from CIMMYT's former computer to its new DEC VAX 11/780.

Staffing

One CIMMYT staff member, a computer programmer and analyst, is assigned to the project.

Project Description

The staff member is asked to participate in the conversion of certain current software programs to the DEC VAX 11/780 computer.

Activities in 1982

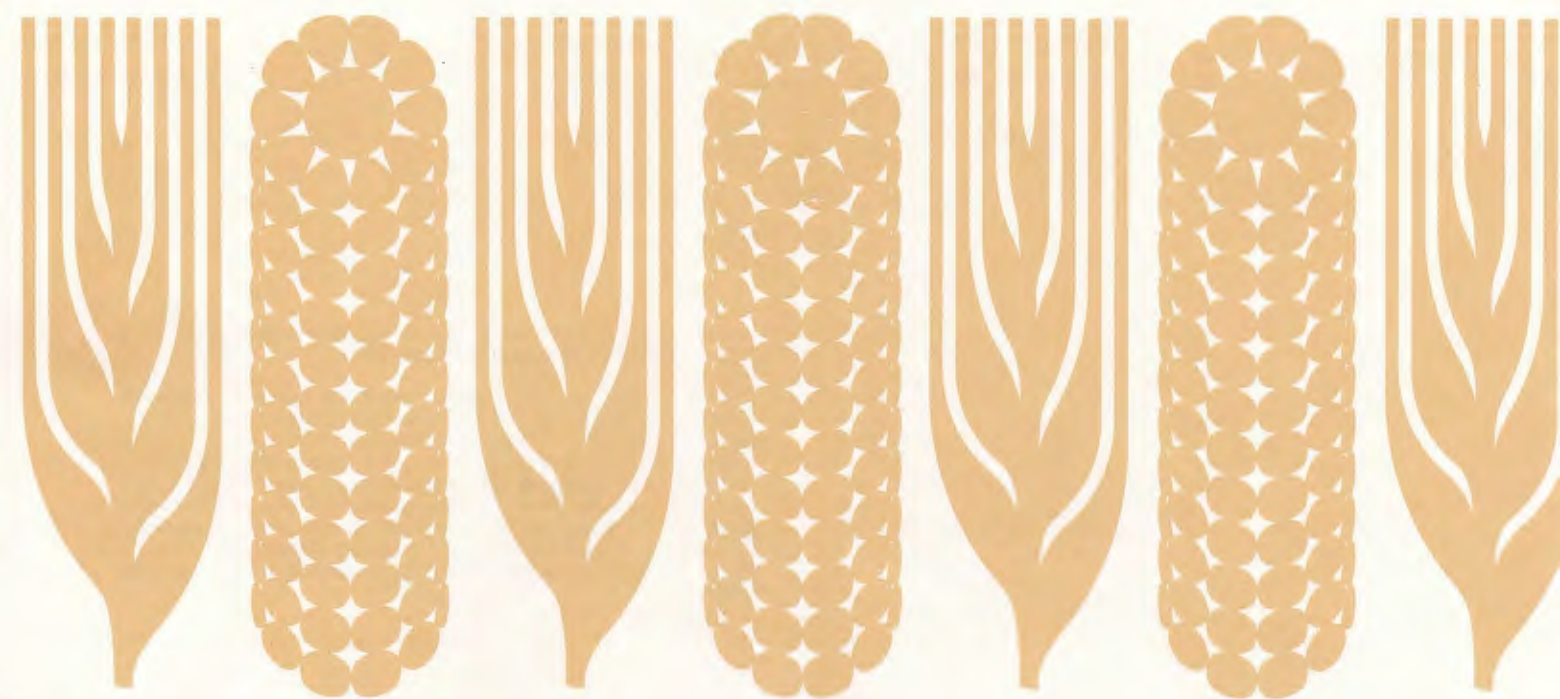
Two major programs have now been re-written for use on the new computer. The Farm Survey Analysis Program (FASAP) has been restructured to take advantage of the additional data processing power of the VAX 11/780 and to make it more user-friendly. Currently, FASAP is being used as a training tool to introduce computing concepts to CIMMYT trainees. Although FASAP was designed and written for the economics program, it also has utility for crop programs.

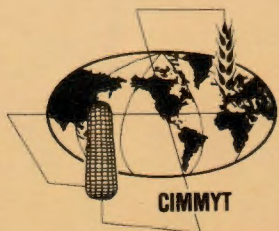
A second program, the Small Grains Summary System (SGSS), has been revamped to further extend CIMMYT's ability to utilize data from small grain screening and yield trials. To do this, a general purpose program has been developed to extract selected variables from input files to the SGSS. Output from this program is suitable for input to general statistical packages, thus broadening the range of possibilities for data analysis and summary.

Work is currently being undertaken to re-write the analytical programs used to process data from CIMMYT's international maize testing network. Several new analysis and reporting routines are expected to be completed during 1983.

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