



Budget Request 1987

CIMMYT



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## Preface

The *1987 Budget Request* is one of three publications that have been prepared in the last twelve months to report on CIMMYT's program of work, accomplishments, financial status, and future funding requirements. One of the companion reports, the *1985 Annual Report*, is a nontechnical description of CIMMYT's activities that also includes the independently audited financial statement, a management review, and highlights of major extra-core grants. The third publication is the *1985 Research Highlights* which highlights major findings and accomplishments in selected research programs.

This *1987 Budget Request* describes CIMMYT's total financial needs—core and extra core—for 1987. It describes the research agenda, the products and services that CIMMYT provides, and the financial and scientific resources required for 1987. The document highlights a number of trends and developments:

- the increase in resources devoted to maize;
- the strengthening of germplasm conservation and evaluation efforts;
- recent efforts to apply new techniques to crop research, such as in wheat wide crosses;
- plans to broaden and strengthen training in conjunction with new physical facilities; and
- plans to add a molecular biologist and an experiment station management specialist to the staff in 1987.

CIMMYT's management and trustees feel that this *1987 Budget Request*, together with its companion publications, provides the information necessary to assess our mode of operations, program achievements, and future plans.

### Executive Summary, Core Programs (US Dollars, Thousands)

	1985 Actual		1986 Current Estimate		1987 TAC Recommended	
	Cost	Man Years	Cost	Man Years	Cost	Man Years
Research	13,874	62.75	14,938	67.00	15,238	69.00
Training	2,966	8.50	3,188	9.00	3,325	9.00
Information	905	3.00	875	3.00	875	3.00
General Administration	1,783	5.25	2,000	6.00	2,000	6.00
Plant Operations	1,464	0.00	1,840	0.00	1,840	0.00
<b>Sub-Total</b>	<b>20,992</b>	<b>79.50</b>	<b>22,841</b>	<b>85.00</b>	<b>23,278</b>	<b>87.00</b>
Contingency <sup>1/</sup>	0	0.00	614	0.00	0	0.00
Inflation/Exchange	0	0.00	0	0.00	1,600	0.00
Capital <sup>2/</sup>	444	0.00	50	0.00	50	0.00
<b>Grand Total</b>	<b>21,436</b>	<b>79.50</b>	<b>23,505</b>	<b>85.00</b>	<b>24,928</b>	<b>87.00</b>

<sup>1/</sup> Accounts for expected funding shortfall in 1986

<sup>2/</sup> Includes expenses due to currency fluctuation in 1985

1985- An underfunding of 4% in the CGIAR was offset partially by reduced dollar requirements at CIMMYT due to devaluation of local currency. Close to 85% of core program expenses were on research, training, and information activities, with the remainder for administrative and operating overheads.

1986- Major objectives include: 1) increasing resources for maize research; 2) continuing development on an expanded program for conservation and evaluation of maize genetic resources; 3) giving greater attention to maintenance research, particularly in wheat; and 4) directing more resources to Africa.

1987- Additions include: 1) appointment of a molecular geneticist; 2) additional staff in experiment stations to collaborate with national programs; and 3) funds to support 10-15 senior visiting scientists as part of an effort to provide a wider range of training opportunities.

# The CGIAR and CIMMYT

## Goals and Objectives

The Consultative Group on International Agricultural Research (CGIAR) is an association of donors, research centers, and developing nations whose goal is:

“To contribute to increasing sustainable food production in developing countries through international research and research related activities in such a way that the nutritional levels and general economic well being of low income people is improved.”

The CGIAR donors provide financial support for the work of 13 independent international agricultural research centers (IARCs) throughout the world. CIMMYT is one of these centers and focuses its attention on maize, wheat, and triticale.

Though an independent institution—CIMMYT, in fact, pre-dates the CGIAR and receives 20% of its funding from other sources—the Center’s work is guided by the goal of the CGIAR. To help reach this goal, the Technical Advisory Committee of the CGIAR has identified eight objectives for the system:

- **Resources:** managing and conserving the natural resource base in developing countries (e.g., soil, water, and genetic resources) for a stable and productive agriculture in the long term.
- **Food Crops:** increasing the productivity of essential food crops with a view to integrating them into sustainable production systems.
- **Livestock:** improving the productivity and ecological capability of livestock production systems.
- **Post-harvest:** achieving, through improvements in post-harvest commodity conversion, storage, and utilization, the more complete utilization of agricultural products in both rural and urban areas.
- **Human health and economic well-being:** promoting better human health and economic well-being through improved nutritional quality of foods, enhanced equity in access to foods, expanded economic opportunities, and better management of overall family resources.
- **Policy:** improving the policy environment so as to ensure the formulation of rational agricultural and food policies which favor increases in food production and productivity through the adoption of enhanced technologies.

- **Strengthening national agricultural research systems:** strengthening agricultural research capacities in developing countries so as to accelerate the indigenous generation, adoption, and effective utilization of enhanced technologies.
- **Integration:** integrating efforts both within and among centers of the CGIAR and, equally important, integrating the objectives of the CGIAR with those of its various partners in the global system.

## CIMMYT’s Products and Services

To meet the goal and objectives stated by the CGIAR, CIMMYT has identified a number of products through which it can respond to the research and training needs of the international community in an efficient manner. These are best described as intermediate goods and services intended to enhance national agricultural research systems’ efforts to develop improved technologies. They include:

- **Improved germplasm:** germplasm for the major production environments in the developing world, including marginal environments.
- **Human resource development:** training agricultural scientists from developing nations.
- **Procedures:** ways to undertake particular tasks for crop improvement and/or management, e.g., germplasm improvement, resource allocation, on-farm research, and insect rearing.
- **Counsel:** (1) exchanges that convey technical information to peers, and (2) strategies related to policy for managers and/or decision makers.
- **Information:** communicating research results of CIMMYT programs, as well as other information of relevance to those engaged in research on maize and wheat.

## The Center’s Organization

CIMMYT has three major programs: Maize, Wheat, and Economics. Within the context of the Center’s mandate these programs are responsible for their own research and training agendas, both in Mexico and in regional and bilateral (national) programs the world over. Each is assisted by several research support units, general administrative services, and information services, which are discussed below.

**Laboratories**—Laboratory staff contribute to crop program research by performing various analyses, including protein quantity and quality, oil content (mainly of maize), milling and baking quality (mainly of small grains), and soil and plant tissue analyses. In addition to offering these services, the laboratory screens seedlings for tolerance to aluminum toxicity. A seed health unit provides pathology support to both the Wheat and Maize Programs and manages CIMMYT's pathology-related greenhouse and laboratory operations.

**Experiment Stations**—This unit manages the land, equipment operations, and field labor for the research stations in Mexico. Four of these stations — El Batán, Poza Rica, Tlaltizapan, and Toluca — are managed directly by CIMMYT. The fifth station, CIANO (located in northwest Mexico near Ciudad Obregón, Sonora), is owned and operated by INIFAP, the Mexican National Research Institute for Agriculture, Livestock, and Forestry. As the Center's research agenda has broadened to address the problems of more marginal

production environments, INIFAP has provided CIMMYT with access to more than a dozen other research sites in Mexico. Logistical support and access to hundreds of additional sites are provided by collaborating national research programs throughout the developing world.

**Data Processing Services**—This unit offers computing and statistical support to all programs. Data processing services have expanded rapidly at CIMMYT in recent years as the Center has sought to improve and streamline its management of research data and administrative information systems.

**Information Services**—CIMMYT's Information Services personnel primarily assist scientific staff in two ways: (1) by communicating their findings to colleagues throughout the world, and (2) by helping them to keep current with relevant research conducted elsewhere. CIMMYT publications and training materials are disseminated to some 6,400 individuals, institutions, and libraries.

## Research and Training Programs in 1985

### Wheat Program

The worldwide production of wheat has grown remarkably since the early 1970s, increasing from 345 to 522 million metric tons (MT) between 1970 and 1984, with roughly half of that increase occurring in developing countries. Burgeoning populations, growing urbanization, rising income levels, and new technologies promoted this rapid increase in wheat production and consumption. To accommodate the growing demand, developing countries have increased wheat imports: about 50 MT were imported in 1983-84 as compared with around 30 MT in the early 1970s. Nearly one-third of this total went to traditional wheat-producing countries in the Middle East and North Africa, but an increasing share (now about 40%, or 20 MT) was destined for tropical countries (23°N–23°S latitudes) where wheat is not a traditional crop. The growing preference for wheat in the tropics portends an even greater future demand by Third World nations.

#### General Objectives

The gains made in Third World wheat production since the early 1970s constitute a striking achievement that is partly the product of the close working relationships established among wheat scientists in national programs and at CIMMYT. However, the rising demand for wheat in developing countries implies a need for steady production increases in the future. CIMMYT's Wheat Program therefore remains dedicated to its overall goal of improving both the level and the dependability of wheat yields throughout the Third World.

The Wheat Program's allocation of resources among bread wheat, durum wheat, and triticale research partially reflects each crop's importance in the developing world. Bread wheat (*Triticum aestivum* L.) is grown on roughly 240 million hectares worldwide (about 90% of the total area devoted to wheat). Approximately 40% of this area is in the developing world (some 100 million hectares), of which 60% is currently planted to spring-habit bread wheats. More than 45 million hectares in developing countries and 10 million hectares in industrialized countries are planted to spring-habit bread wheat varieties carrying CIMMYT germplasm in their pedigrees. To date, national crop improvement programs have released over 350 bread wheat varieties based to varying degrees on CIMMYT germplasm. In accordance with these realities, bread wheat commands approximately 60% of the Program's direct research resources.

Durum wheat (*T. durum*) is grown on about 14 million hectares in the developing world, with 60% of this area located in the Mediterranean Basin countries of North Africa and the Middle East. Approximately 60% of all durum wheat produced in developing countries is grown in semiarid regions; the remainder is grown either under irrigation or in locations receiving more than 500 mm of

precipitation per crop cycle. Cooperating national programs have released 48 high-yielding durum varieties based on CIMMYT germplasm. Although on a global basis durum wheat is clearly of lesser significance than bread wheat, its importance in some regions is great; and because comparatively less research has been done on durums, the potential for germplasm improvement in the near term is probably greater for durum wheat than for bread wheat. Consequently, about 20% of the Wheat Program's direct research resources are devoted to durums.

As for triticale, progress in its development reflects a remarkable research achievement. Triticale shows good adaptation to difficult production environments, including acid soils with high concentrations of soluble minerals (i.e., aluminum) or cool highland production areas where heavy disease pressure exists. In such environments, triticale can yield much more than wheat. Triticale test weights and bread-making quality have improved significantly since the Center's research efforts began, and during the past two decades, mostly since 1979, more than 40 triticale varieties have been released in 11 countries. It is estimated that 750,000 hectares around the world are now planted to triticale, and many of the varieties in use stem from the CIMMYT network. Although much of this area is located in developed countries, triticale's proven adaptation to marginal environments in developing countries makes it likely that production will expand in these areas. Even so, triticale remains an experimental effort and, accordingly, some 20% of the Wheat Program's resources are invested in this crop.

**Enhancing resource productivity**—The CIMMYT Wheat Program believes that the greatest potential for increasing the productivity of resources committed to wheat in the near future lies in more effectively transferring appropriate technology, developed by national and international research programs, to farmers in developing countries. On-farm research, improved distribution of production inputs, and a greater emphasis on advanced training of national program scientists, all combined with government policies to encourage domestic production, can augment wheat production in these countries.

**Improving genetic yield potential**—The Wheat Program contends that realistic, longer term possibilities exist for the continued improvement of wheat's genetic yield potential. Even though a dramatic jump in yields such as accompanied the advent of semidwarf wheats is not anticipated, we are convinced that a slow, steady gain in yield potential can be realized. Toward this end, the Program continues to exploit the highly successful approaches of (1) making numerous crosses within individual gene pools, and (2) thoroughly examining the numerous genetic combinations possible from crossing cultivars from different gene pools, such as spring x winter combinations.



**Improving yield dependability**—Of equal importance to improving genetic yield potential, however, is the effort to improve yield dependability across environments. This goal is being attained in several ways: (1) by improving the resistance of CIMMYT germplasm to various diseases and insects, (2) by increasing its tolerance to problem soils, and (3) by improving tolerance to such environmental stresses as drought and excessive heat.

For example, work in wide crosses—incorporating into wheat certain desirable genetic traits from related alien species—is receiving greater attention. The focus of this research is not higher genetic yield potential *per se*, but rather better resistance to diseases and greater tolerance to environmental extremes. Successful introgression of useful genetic material will increase yield dependability and raise yields as well; it is also hoped that better tolerance to drought and saline soils can be obtained. At present, the Wheat Program engages in collaborative wide crosses research with the University of Utah, the Plant Breeding Institute at Cambridge, Colorado State University, CSIRO in Australia, and other institutions.

### **Program Organization**

The three wheat sub-programs (bread wheat, durum wheat, and triticale) are assisted in their research by a number of support programs and/or specialities (pathology, special germplasm development, wide crosses, wheat germplasm bank, wheat milling and baking laboratory, international testing, agronomy, and training programs). Four regional wheat programs are also in operation: South and Southeast Asia; Eastern, Central, and Southern Africa; the North and West Africa and Iberian Peninsula Region; and the Andean Region of South America. Regional activities in the Southern Cone of South America came to a close in 1986. These regional programs link CIMMYT research activities more closely with those of national programs. CIMMYT staff also work directly in national programs in Pakistan, Bangladesh, Peru, and Turkey. Cooperative bread and durum wheat improvement projects are conducted with ICARDA. CIMMYT has a bread wheat breeder and a durum breeder posted at ICARDA headquarters, their purpose being to facilitate the development of improved germplasm for dry environments in conjunction with ICARDA scientists. Similarly, CIMMYT hosts an ICARDA barley breeder who focuses on developing materials for Latin America.

### **Program Activities in 1985**

In 1985, collaborating scientists in 96 countries requested 2,085 trials of bread wheat, durum wheat, and triticale from 29 different nursery categories. This array of nurseries reflects the Wheat Program's emphasis on developing broadly adapted germplasm: in 1985, nursery categories included early generation and

advanced germplasm suitable for dryland as well as irrigated conditions; special disease problems; soil and heat stresses; and drought tolerance.

CIMMYT increasingly relies on its regional staff to guide and implement the multilocal testing mentioned above. This relationship involves greater use of research networks, institutional collaboration, and more region-specific germplasm development and improvement.

The Center has also established specific collaborative research arrangements with selected national programs that are strategically located to address particular problems. In these projects, germplasm is shuttled between Mexico and the national programs so that alternate cycles of improvement take place at each location. Examples of such collaborative research include the CIMMYT/Oregon State University/Turkey spring x winter wheat research project; the CIMMYT/Brazilian aluminum-tolerant bread wheat breeding program; and the CIMMYT/China cooperative shuttle-breeding program for fusarium head scab resistance. Wheat production on millions of hectares of land in more marginal environments can potentially be increased as a result of this research.

The Wheat Program has also embarked on a joint venture, implemented under the bilateral agreement between the government of Turkey and CIMMYT, to develop broadly adapted, high-yielding winter wheat germplasm for the extensive winter and facultative wheat areas in Turkey and elsewhere. This cooperative effort will involve agricultural research centers in winter wheat environments around the world. Turkey's diverse wheat environments and its strong national wheat research program make it an ideal location from which to conduct such a project.

Other international cooperation involves the Wheat Program's germplasm bank. In 1985, the bank contained approximately 60,000 total entries, including 10,500 of bread wheat, 4,500 of durum wheat, 5,100 of triticale, 4,900 of barley, and 1,100 of interspecific germplasm. Some 33,700 entries from other germplasm banks around the world were also in storage. Seed of 2,620 collections was supplied to collaborators from national programs.

During the year, approximately one-fourth of the entries, including more than 3,500 newly received collections of winter growth-habit materials, were regenerated. Germination viability tests were conducted on approximately one-third of the bank entries, and good to excellent results were observed in virtually all of them. Efforts to computerize information on the bank's collections continued, and the input of introductory data on virtually all entries was completed. Finally, duplicates of nearly 19,000 entries were sent to the USDA National Seed Storage Laboratory (NSSL) in Ft. Collins, Colorado, for long-term storage.



## Maize Program

Maize, with a 449 MT global harvest in 1984, ranks second to wheat (with rice third) among the world's cereal crops. Worldwide, about 66% of all maize is used to feed livestock, whereas 25% is for human consumption and 9% is used for industrial purposes and seed. In 1984, developing countries produced 170 MT of maize, with roughly 50% destined for direct human consumption, 43% for animal feed, and the remainder for use in industry and as seed.

Maize for human consumption is particularly important in Sub-Saharan Africa, Mexico, Central America and the Caribbean, and the Andean countries of South America, where maize is a staple food for the rural poor. In recent years, demand for maize as feed has also grown rapidly in the Third World, especially in newly industrializing, middle-income countries that are not traditional maize producers. Rising income levels in these countries, particularly in urban areas, have resulted in rapid increases in meat and poultry consumption. This situation—much like that of wheat—portends a growing demand for maize products and implies the need for continued research and training on CIMMYT's part.

### General Objectives

Future maize demand will be influenced by two key factors: population and income growth. In developing countries where maize is a dietary staple, demand for maize to be used directly as food is expected to rise in line with population growth, but could grow faster in chronically food-deficient areas. Future demand for maize as a feed grain depends primarily on national economic growth rates, especially in the recently industrializing countries of Asia and Latin America. Given the economic growth forecasted, demand for maize as feed could increase by 3-4% per capita during the remainder of the 1980s and at even higher rates in decades beyond. When population and income growth are taken into account, the developing world will likely require an additional 130 MT of maize to satisfy annual demand by the year 2000. As the amount of land available for maize production decreases, greater use of yield-increasing technologies will be critical if developing countries are to take advantage of this growing demand.

To date, maize has attained its highest yield levels in the temperate areas of the world where modern agricultural production technologies are employed. Although approximately 50% of the world's maize area is in developing countries, only 25% of the world's maize crop is harvested there. Indeed, the difference between the average maize yield of the developed market economies and that of the developing world is more than 3 t/ha.

Numerous factors explain the difference in maize yields between tropical and temperate zones. In most developing countries, maize is grown as a subsistence, rainfed crop in a short, hot season, usually under low fertility, and is generally subject to periodic drought and/or excesses of water at different stages of the growth cycle. Effective weed and pest control are often lacking. Furthermore, traditional tropical maize varieties are not very efficient for grain production: they are tall, leafy, and subject to lodging. Their grain-to-stover ratio is low and they are less responsive to high planting densities and improved management.

Significant research efforts to develop more grain-efficient maize for tropical areas began less than 20 years ago. Until recently, most national breeding programs have been handicapped in this endeavor by the narrow genetic base of the materials available to them. Today, a wide range of superior germplasm is available for most lowland and many intermediate elevation environments of the developing world. This germplasm requires further refinement and extensive testing before it can be released to farmers for widespread use.

In several parts of the developing world—for example, in India (winter maize), Brazil, and Guatemala—the adoption of technologies for producing higher yields is beginning; these successes, however, must be repeated in many other parts of the developing world, especially in Asia and Sub-Saharan Africa, during the remainder of this century.

### Program Organization

The Maize Program's research organization has scientists posted at headquarters and at regional and national programs outside Mexico. At headquarters, scientists are assisted by a number of research support units (plant protection, physiology/agronomy, germplasm bank, wide crosses, and international testing). In addition, 15 maize specialists are assigned among six regional program posts (Andean countries; Central America, Mexico, and the Caribbean; East and Southern Africa; West Africa; Asia; and Middle East and North Africa). Staff also work in national programs in Ghana and Pakistan.

### Program Activities in 1985

In 1985, CIMMYT worked on 67 gene pools and advanced populations. Drawing on the many sources of genetic diversity in the CIMMYT germplasm bank, researchers improved 37 gene pools—24 normal and 13 quality protein maize (QPM)—using fairly mild selection pressure. These gene pools are genetic reservoirs formed by mixing different germplasm with similar adaptation, maturity, grain color, and texture. From the best fraction of the pools, CIMMYT has developed more refined populations that are improved through applying greater selection pressure. In 1985, CIMMYT worked 32 such populations—22 normal maize and 10 QPM—

suited to a range of climatic conditions (tropical, subtropical, temperate); maturity periods (early, intermediate, late); grain color (yellow, white); and kernel type (flint, dent).

Experimental varieties developed through the international testing program continue to show superior yield potential and dependability, and means of improving the yield stability of these materials even further continue to be explored. Toward this end, a collaborative study was undertaken in 1985 with the Plant Breeding Institute at Cambridge, UK, in which a statistician spent six months at CIMMYT headquarters analyzing recent data from the maize international testing program. The study helped develop methods to analyze genotype x environment interactions and to identify high-yielding genotypes showing stable yield performance over a range of environments.

In 1985, CIMMYT and IITA entered into a joint project with scientists from the University of Zimbabwe, Harare, to accelerate the development and adoption of improved midaltitude germplasm in eastern and southern Africa. To carry out this work, CIMMYT and IITA assigned two scientists—a breeder and an entomologist—to the project.

CIMMYT/IITA collaborative research with several West African national programs on resistance to streak virus continues to make progress. IITA provided access to its insect-rearing facilities to produce the insect vector needed to ensure adequate selection pressure. Sources of resistance have been found in La Posta (pop. 43), one of CIMMYT's high-yielding tropical lowland white dent populations, and five experimental varieties have been formed based on that material.

A major effort has also been made to integrate streak resistance into superior experimental varieties from other promising CIMMYT populations. The most advanced of these conversions were included in variety trials in 1985 for testing in relevant environments throughout tropical Africa. In addition, families from the streak resistant conversion of experimental varieties were screened for resistance to the parasitic weed, *Striga hermontica*, and promising materials were identified. Four early maturing QPM materials and a yellow flint population with downy mildew resistance from Thailand (Suwan-1) were also added to the conversion program in 1985.

Until recently, the Maize Program emphasized the development of open-pollinated varieties in its improvement work. This emphasis prevailed for several reasons. The primary factor was the lack of adequate seed production and distribution systems necessary for a hybrid seed strategy to work. A second factor has been that hybrids, compared to open-pollinated varieties, have not shown a profitable yield advantage

when grown under the production conditions of resource-poor farmers, who produce most of the maize in developing countries.

However, maize production conditions in the developing world are not uniform, although they continue to improve. Under more productive conditions, high-yielding and uniform hybrids used with improved agronomic practices offer the potential for significant yield increases. Though the development of open-pollinated varieties will remain a central feature of CIMMYT's work for some time to come, in 1985 the Center established a hybrid development program in response to growing national program requests for research collaboration and assistance. Through this work, information will be generated about the inbreeding depression and heterotic patterns of CIMMYT's broad-based pools and populations. Research and training on the development and production of nonconventional hybrids will also be undertaken.

## Economics Program

The work of the Economics Program is best described in the context of a set of postulates about farmers and the demand for international agricultural research. The Program assumes that farmers in developing countries are purposeful in their behavior, that they are reasonably effective in allocating the scarce resources at their disposal, and that income and risk influence their decisions considerably. With regard to agricultural research, it is felt that most agricultural research should aim at increasing productivity and that national programs are responsible for developing improved technologies for farmers.

### General Objectives

Together, these views of farmers and agricultural research help shape the objectives of the Economics Program and are reflected in the three basic services it provides. The first consists of developing cost-effective procedures to enhance researchers' capacity to provide data and analysis for decision making. The second service is training, dealing mostly with using on-farm research procedures (described later in this report) for technology generation. The Program's third service is to collect and analyze data for CIMMYT management and others. Most of this work is done at the farm level and involves collaboration with biological scientists.

### Program Activities in 1985

**Development of procedures**—The Economics Program develops procedures to facilitate national program research in three areas: technology generation, research resource allocation, and policy implementation. The same strategy is used to develop all three kinds of procedures. First, cooperative work is undertaken with agronomists and economists in national programs, and

procedures are evolved. These are later synthesized in manuals, and training methods in the application of the procedures are generated.

- **Technology generation:** From the outset, the Economics Program staff has worked with selected national programs to develop, demonstrate, and institutionalize on-farm research procedures. In 1985, more than a dozen collaborating national research institutes in Africa, Asia, Latin America and the Caribbean were well on the way toward integrating on-farm research procedures into their operations. This exchange between national programs and CIMMYT contributes both to refining on-farm research procedures and developing institutional innovations that make national production research more effective.
- **Allocation of research resources:** This set of procedures is designed to help researchers gain information about the assignment of research resources to crops and to regions, with the aim of providing information about the underlying economic competitiveness or comparative advantage of different crops in specific regions. Economics program staff, in cooperation with national program colleagues, engaged in two such studies in 1985. The first, in Pakistan, examined the choice of crops from research investment in one region, whereas the work in Kenya studied alternate scales of wheat technology. Field work was undertaken in each country and preliminary analyses were done; researchers took great care to depict the relatively complex farming patterns accurately for economic analysis. With these case studies, the Program seeks to amass enough information to assemble a manual to guide national program personnel and other policy makers concerned with allocating research resources.
- **Policy assessment:** Farm-level research is employed to evaluate the adequacy of systems for delivering inputs, marketing products, disseminating information, and providing credit; to estimate the direct losses in production associated with inadequate implementation of present policies; and to identify avenues through which system support might be improved. The eventual goal of this work is to derive cost-effective methods for undertaking such research and, again, to synthesize these procedures in manuals for national program researchers. This work is conducted on a limited basis, with the allocation of more resources dependent on progress.

**Data generation and analysis**—The Economics Program has been giving more attention to data collection and analysis of maize and wheat world economies. In 1985, CIMMYT published *World Wheat Facts and Trends: A Discussion of Selected Wheat Marketing and Pricing Issues in Developing Countries*. This publication

examines several aspects of wheat marketing and pricing in the Third World, reviewing wheat marketing systems in 13 countries. Comparisons of price differentials in each of the wheat markets emphasized that marketing functions assume greater importance for farmers as economic growth increases, and that technologies for grain transportation, storage, and processing need to be adapted to the circumstances of each particular country. The alternative wheat pricing mechanisms reviewed demonstrated the wide array of methods currently employed to set wheat prices, and revealed the necessity for improved wheat pricing arrangements in developed and developing countries.

## Training and Conferences

Training continues to be a major dimension of CIMMYT's total institutional effort (Table 1). Training in Mexico, within the regions, and in national program settings stresses the strengthening of field and laboratory research skills needed to conduct effective crop research programs. An increasingly diverse number of training opportunities are offered.

**In-service training in Mexico**—CIMMYT's major training activity is aimed at developing the scientific skills of middle-level research workers. In-service training courses emphasize learning-by-doing to improve the research practitioner skills of agricultural workers. In the Wheat Program, four courses are offered: crop production, crop improvement, cereal technology, and experiment station management. In the Maize Program, the mix is slightly different: crop production, crop improvement, protein quality laboratory analysis, and experiment station management.

**Table 1. Summary of CIMMYT training activities in Mexico, 1985**

Type of Training	Participants	Countries
In-Service		
Maize	50	27
Wheat	49	26
Exp. Stations	18	14
Laboratories	6	5
Visiting Scientists		
Maize	36	20
Wheat	68	23
Economics	18	7
Research Support	3	2
Pre- and Postdoctoral Fellows		
Maize	8	5
Wheat	9	6
Economics	2	2

Most in-service trainees are enrolled in the maize or wheat production agronomy courses, which emphasize the importance of on-farm research for developing and/or identifying relevant production technologies to recommend to farmers. Economics Program staff participate in this training. The crop improvement courses rank second in terms of number of trainees.

**Visiting scientists**—Travel fellowships are provided to senior national researchers to visit CIMMYT for consultation, refresher courses, or more direct participation in selecting germplasm.

**In-service training outside Mexico**—CIMMYT's outreach staff, with assistance from headquarters staff, are especially involved in these training activities, which are generally held as national in-service training courses. The Economics Program has been particularly active in this area. In 1985 more than a dozen in-country training programs were organized for 600 participants.

**Graduate student fellowships**—CIMMYT helps manage and direct graduate student training and thesis research for collaborators from national programs who obtain scholarships for graduate studies. A limited number of thesis research opportunities are offered to doctoral candidates under CIMMYT supervision, usually in Mexico.

**Pre- and Postdoctoral fellowships**—This program is designed to prepare new professionals for career opportunities in international agricultural research, and to bring to CIMMYT new knowledge on selected research topics. Five doctoral candidates were in residence in the maize and wheat programs in 1985. Maize thesis research was conducted on insect resistance, nitrogen uptake efficiency, and tar spot (*Phyllachora maydis*) resistance; wheat thesis research focused on resistance to the aphid, *Diuraphis noxia*, and to Karnal bunt (*Tilletia indica*).

Seventeen postdoctoral fellows worked in CIMMYT's research programs on one to two year assignments. In addition to their regular programs of work, some of these fellows conducted special research studies, including various statistical analyses of yield stability from international testing data to help assess and improve the efficiency of CIMMYT's breeding methods.

**Conferences**—CIMMYT sponsors conferences with the goal of improving the coordination of activities within the international research networks or of conducting state-of-the-art research reviews on selected topics. Outreach staff are also active in organizing workshops with national program collaborators on topics of regional importance.

During 1985, CIMMYT cosponsored a number of conferences, both at headquarters and on a regional or national basis. At headquarters, in-house program reviews were conducted in the Maize Program on all aspects of maize research. In June, CIMMYT hosted a workshop attended by computer and data processing staff from other international institutes and developing country national programs to facilitate the joint development of software applications. As a result of this meeting, mutual needs were identified and individual software applications were shared. An August workshop on winter wheat was attended by 25 participants, including scientists from China, Yugoslavia, and the USA. The first Eastern, Central, and Southern Africa Regional Maize Workshop, held in Zambia in March, was attended by maize researchers from 23 countries; a proceedings of this conference is now available. A similar regional wheat workshop was also sponsored in Kenya in September for national program scientists from Eastern, Southern, and Central Africa.

## Information

In 1985, CIMMYT published 47 new titles in English, Spanish, and French, distributing them according to interest areas using a mailing list of some 6,400 individuals, institutions, and libraries. The 1985 publications output included major conference proceedings on Latin American research priorities and on wheats for more tropical environments. Six issues of the *Wheat, Barley, and Triticale Abstracts* and six of *Maize Abstracts* were co-published with the Commonwealth Agricultural Bureaux (CAB), and each was distributed to 500 individuals and libraries. Five issues of the *Wheat, Triticale, Barley Bibliography*, co-published with FAO's AGRIS, were sent to 600 research collaborators and technical wheat libraries in the developing world.

## Financial Summary 1985

Total revenues were close to US\$25 million in 1985. As in past years, over 95% of these revenues were in the form of grants to CIMMYT. Other major contributors to total revenues were administrative fees on grants and interest income. Total expenses were greater than revenues, with the difference due to a loss realized on the translation of peso-denominated assets (this is an accounting construct required under accepted practices). Without this, total expenses were equal to total revenues.

Over half of all expenses went to direct research expenses in maize, wheat, and economics. Training programs and offices accounted for 14% of expenses, research support 11%, and information 3%. Thus more than 80% of CIMMYT's expenditures were directly related to research and training activities. Administrative and operating support together accounted for 13% of expenses, with capital and translation utilizing the remaining 4% of total. Table 2 summarizes CIMMYT's sources and use of funds during 1985.

Both the core and extra-core funds were well below budget in 1985. The decline in core funds was due to several factors: (1) an underfunding against budget of 4% in the CGIAR; (2) reduced dollar-denominated requirements at CIMMYT due to the devaluation of the peso; and (3) a large write-down on one grant in which the donor is obligated to pay at the controlled peso/dollar exchange rate, i.e., a substantial discount from the free or market rate. To accommodate these changes, training opportunities, mainly visiting scientist fellowships, were reduced, and the experiment station and plant operations budgets were reduced, since they were largely peso-denominated and therefore sensitive to exchange rate fluctuations.

Extra-core programs were affected little by the devaluation of the peso. Nearly all of these programs are dollar denominated, and most are located outside of Mexico. Similarly, because these programs are bilateral relationships negotiated in advance, they are not subject to changes in CGIAR funding. The difference from budget is due instead to shortfalls in program activities—mainly in training fellowships—and delays in initiating some regional and national programs. Because

Table 2. 1985 financial summary, budget vs. actual (US Dollars, Thousands) 1/

	Core Budget	Extra-Core Budget	Total	Core Actual	Extra-Core Actual	Total
<b>Sources</b>						
Grants	21,861	4,804	26,665	20,267	3,447	23,714
Admin. Fees	631		631	509		509
Sale of Crops, etc.	25		25	39	39	
Interest Income	450		450	309		309
Total Sources	22,967	4,804	27,771	21,124	3,447	24,571
<b>Uses</b>						
<b>Research</b>						
Wheat	5,454	1,845	6,939	5,336	1,081	6,417
Maize	4,704	1,731	6,435	4,915	1,075	5,990
Economics	1,020	410	1,430	870	473	1,343
<b>Research Support</b>						
Labs	607		607	526		526
Exp. Stations	1,804		1,804	1,530		1,530
Data Processing	697		697	697	12	709
<b>Training</b>						
Information	3,830	1,069	4,899	2,966	727	3,693
General Administration	818	109	927	905	79	984
Plant Operations	2,052		2,052	1,783		1,783
Contingencies	1,909		1,909	1,464		1,464
Capital	22		22	-0-		-0-
Translation Effect	50		50	132		132
Total Uses	-0-		-0-	312		312
Balance	22,967	4,804	27,771	21,436	3,447	24,883
	-0-	-0-	-0-	(312)	-0-	(312)

1/ Not including construction costs of new training building

these grants generally have flexible budgeting arrangements, shortfalls and delays usually only result in the deferral of activities.

Staffing patterns deviated only slightly from budget during the year, as shown in Table 3. Core-funded manpower was slightly under budget, which was the result of internal staff transfers. Extra-core programs were over budget by 1.0 man year because one staff member was transferred from a core project.

Roughly half of CIMMYT's staff are based at headquarters, and all, save one, are on core funding. This figure includes scientists in the three research programs, as well as research support, information, and general administrative staff. The second largest group is the regionally based scientists, who represent 35% of all staff. Lastly, training and national programs each represented 10% of total staff. These percentages are approximately in line with the level of funding for each group.

**Table 3. 1985 International staff years, budget vs. actual**

	Core Budget	Extra-Core Budget	Total	Core Actual	Extra-Core Actual	Total
<b>Wheat</b>						
Headquarters	16.5	-0-	16.5	14.5	1.0	15.5
Regional Programs	10.0	1.0	11.0	10.5	1.0	11.5
National Programs	-0-	5.0	5.0	-0-	5.0	5.0
Total	26.5	6.0	32.5	25.0	7.0	32.0
<b>Maize</b>						
Headquarters	12.5	-0-	12.5	12.5	-0-	12.5
Regional Programs	13.0	3.0	16.0	13.0	3.0	16.0
National Programs	-0-	3.0	3.0	-0-	3.0	3.0
Total	25.5	6.0	31.5	25.5	6.0	31.5
<b>Economics</b>						
Headquarters	2.0	-0-	2.0	1.75	-0-	1.75
Regional Programs	4.0	2.0	6.0	4.0	2.0	6.0
National Programs	-0-	1.0	1.0	-0-	1.0	1.0
Total	6.0	3.0	9.0	5.75	3.0	8.75
Research Support	6.5	-0-	6.5	6.5	-0-	6.5
Training & Conferences	8.0	-0-	8.0	8.5	-0-	8.5
Information Services	3.0	-0-	3.0	3.0	-0-	3.0
General Admin. & Plant Operations	6.0	-0-	6.0	5.25	-0-	5.25
Total Headquarters	46.5	-0-	46.5	43.5	1.0	44.5
Total Regional Programs	27.0	6.0	33.0	27.5	6.0	33.5
Total National Programs	-0-	9.0	9.0	-0-	9.0	9.0
Total Training	8.0	-0-	8.0	8.5	-0-	8.5
<b>Grand Total</b>	<b>81.5</b>	<b>15.0</b>	<b>96.5</b>	<b>79.5</b>	<b>16.0</b>	<b>95.5</b>

## 1986 Prospects

### Planning and Strategy

Both financial and program parameters figure prominently in the planning and execution of the operating strategy for 1986. For core programs, three financial factors will continue to be critical: the level of donations, inflation in Mexico, and the exchange rate. At this juncture the financial outlook is not optimistic; donations are likely to run at 96% of budget, and inflation in Mexico will probably remain high relative to that of other nations. Only the apparent continued weakness in the US dollar may have an ameliorating effect. Extra-core programs are more buffered by external financial factors and so are not likely to suffer abrupt changes in budget levels.

CIMMYT's 1986 operating budget calls for \$28,310,000 in program and capital funds and 104.0 international staff man years. Core funds are programmed at \$23,505,000 and are used to support 85.0 man years. Extra-core programs occupy the remainder of the budget, i.e., \$4,805,000 and 19.0 international staff man years. The distribution of funds is approximately 80% core and 20% extra core.

Of the total budget, close to 50% of funds is devoted to headquarters research efforts, 14% to training programs, 15% to regional activities, 7% to support national programs, and 13% for administrative support. The remaining 2% of funds is for capital and contingencies. Table 4 summarizes the projected sources and use of funds in 1986.

Table 4. 1986 financial summary (US Dollars, Thousands)

	Core		Extra Core		Total	
	Cost	Man Years	Cost	Man Years	Cost	Man Years
<b>Sources</b>						
Grants	22,526		4,805		27,331	
Admin. Fees	604				604	
Sale of Crops, etc.	350				350	
Interest Income	25				25	
Total Sources	23,505		4,805		28,310	
<b>Uses</b>						
Wheat	5,200	26.0	1,589	7.0	6,789	33.0
Maize	5,456	29.0	1,478	8.0	6,934	37.0
Economics	1,093	6.0	677	4.0	1,770	10.0
Laboratories	616	2.0	-0-	-0-	616	2.0
Experiment Stations	1,823	2.0	-0-	-0-	1,823	2.0
Training and Conferences	3,188	9.0	978	-0-	4,166	9.0
Information	875	3.0	83	-0-	958	3.0
General Admin.	2,000	6.0	-0-	-0-	2,000	6.0
Data Processing	750	2.0	-0-	-0-	750	2.0
Plant Operations	1,840	-0-	-0-	-0-	1,840	-0-
Contingency <sup>1/</sup>	614	-0-	-0-	-0-	614	-0-
Capital	50	-0-	-0-	-0-	50	-0-
<b>Total</b>	<b>23,505</b>	<b>85.0</b>	<b>4,805</b>	<b>19.0</b>	<b>28,310</b>	<b>104.0</b>

<sup>1/</sup> For possible funding shortfall



Program objectives for 1986 reflect the array of activities on CIMMYT's research agenda. These include:

- Increasing staff in maize so that by the end of 1986, 9 staff will have been added since 1984. This reflects a concern for additional and continued work on germplasm for a variety of ecological zones and agroclimatic conditions.
- Continuing the development of an expanded program for the conservation and evaluation of maize genetic resources.
- Giving greater attention to maintenance research, particularly in wheat.
- Devoting considerable resources to Africa, particularly in maize and economics. In 1984 a staff member was assigned to SAFGRAD and an

agreement with IITA was concluded; in 1985 regional staff were assigned to Southern Africa (midaltitude maize) and to East Africa; and in 1986 an agronomist and an economist will be assigned to Southern Africa. These persons will engage in the full range of research and training activities, and will considerably enhance CIMMYT's ability to serve national agricultural research systems in Africa.

- Assigning more resources in wheat to work on problems associated with stress, especially in warmer environments. This will entail a shift in regional staff from the Southern Cone to another area.

Table 5 describes the sources and uses of core funds over 1984-1986. Most notable is the 25% increase in resources—both financial and scientific—to maize. Core resources for wheat, on the other hand, have declined and those for economics increased slightly.

**Table 5. Core summary, 1984-1986 (US Dollars, Thousands)**

	1984		1985		1986	
	Cost	Man Years	Cost	Man Years	Cost	Man Years
<b>Sources</b>						
Grants	19,828		20,267		22,526	
Admin.Fees-Ex.Core	443		509		604	
Interest Income	508		309		350	
Other Income	24		39		25	
Carry Forward	69		-0-		-0-	
<b>Total Sources</b>	<b>20,872</b>		<b>21,124</b>		<b>23,505</b>	
<b>Uses</b>						
Wheat	5,843	25.5	5,336	25.0	5,200	26.0
Maize	4,282	23.25	4,915	25.5	5,456	29.0
Economics	960	5.5	870	5.75	1,093	6.0
Laboratories	526	2.0	526	2.5	616	2.0
Experiment Stations	1,453	2.0	1,530	2.0	1,823	2.0
Training & Conferences	2,721	7.25	2,966	8.5	3,188	9.0
Information	789	3.0	905	3.0	875	3.0
General Admin.	1,504	6.0	1,783	5.25	2,000	6.0
Data Processing	764	2.75	697	2.0	750	2.0
Plant Operations	1,475		1,464		1,840	-0-
Contingency 1/	-0-		-0-		614	-0-
<b>Sub-Total</b>	<b>20,317</b>	<b>77.25</b>	<b>20,992</b>	<b>79.5</b>	<b>23,455</b>	<b>85.0</b>
Capital	482		132		50	
Translation Effect 2/	303		312		-0-	
<b>Total Uses</b>	<b>21,102</b>	<b>77.25</b>	<b>21,436</b>	<b>79.5</b>	<b>23,505</b>	<b>85.0</b>
<b>Balance</b>	<b>(230)</b>		<b>(312)</b>		<b>-0-</b>	

1/ Distributed to programs during 1984, 1985; for 1986, accounts for expected funding shortfall

2/ Translation is the expense arising from the change in value in net assets due to currency fluctuations

Extra-core programs are summarized in Tables 6 and 7. They have grown considerably in recent years and now help fund certain research and training activities at headquarters, in the regions, and in national programs. Two important extra-core programs have been launched at headquarters. The wheat wide crosses grant, funded by a biotechnology consortium, is an exploratory research effort that may have a large impact on germplasm development and improvement at CIMMYT. The barley yellow dwarf virus project is the second large extra-core program at headquarters. Both projects involve institutional collaboration and are especially important for their potential to develop, transfer, and share information on these important scientific themes.

In recent years, another area of growth in extra-core grants has been in regional programs. These grants are important because they complement regional activities funded by core donors. The recent grants in Eastern and Southern Africa, for example, focus on training in crop management, institutional collaboration, and research networks. These efforts help augment national program capacities to develop appropriate technologies and to make CIMMYT's efforts in germplasm development more useful.

Direct assistance to national programs continues to be funded by extra-core grants. These grants permit CIMMYT to provide not only direct assistance to

**Table 6. Extra-core summary, 1984-1986 (US Dollars, Thousands)<sup>1/</sup>**

	1984 Actual		1985 Actual		1986 Budget	
	Cost	Man Years	Cost	Man Years	Cost	Man Years
<b>Wheat</b>						
Headquarters	87	-0-	281	1.0	505	1.0
Regional Programs	40	1.0	109	1.0	161	1.0
National Programs	662	5.0	691	5.0	923	5.0
Total	789	6.0	1,081	7.0	1,589	7.0
<b>Maize</b>						
Headquarters	5	-0-	-0-	-0-	-0-	-0-
Regional Programs	87	1.0	392	3.0	777	5.0
National Programs	929	3.0	683	3.0	701	3.0
Total	1,021	4.0	1,075	6.0	1,478	8.0
<b>Economics</b>						
Headquarters	-0-	-0-	-0-	-0-	-0-	-0-
Regional Programs	214	2.0	328	2.0	350	3.0
National Programs	89	1.0	145	1.0	327	1.0
Total	303	3.0	473	3.0	677	4.0
<b>Other Programs</b>	-0-	-0-	91	-0-	83	-0-
<b>Training</b>						
Wheat	287	-0-	286	-0-	454	-0-
Maize	222	-0-	282	-0-	384	-0-
Economics	184	-0-	159	-0-	140	-0-
Total	693	-0-	727	-0-	978	-0-
<b>Summary</b>						
Headquarters	121	-0-	372	1.0	588	1.0
Regional Programs	341	4.0	829	6.0	1,288	9.0
National Programs	1,672	9.0	1,519	9.0	1,951	9.0
Training	693	-0-	727	-0-	978	-0-
Total	2,827	13.0	3,447	16.0	4,805	19.0

1/ Not including training building or cooperative programs

national agricultural research systems but help these programs forge important links to the overall research effort at CIMMYT. The national program in Bangladesh, for example, helps increase CIMMYT's knowledge about tropical wheat both in germplasm development and crop management. In Haiti, the development of on-farm research capabilities provides important information for

CIMMYT's activities in economic analysis, crop management, and institutional collaboration. Relations with national programs are thus mutually beneficial: the national programs receive the research products and continuity that CIMMYT is able to offer, and provide feedback for assessing and improving the Center's research and training activities.

**Table 7. 1986 Extra-core grants**

	Program	Admin. Fee	Total	Man Years
<b>Wheat</b>				
CIDA/Bangladesh	510	90	600	2.0
CIDA/E.Africa	211	32	243	1.0
USAID/Pakistan	487	35	522	1.0
INIPA/Peru	113	15	128	1.0
Italy/BYDV	470	65	535	1.0
UNDP/Turkey	140	20	160	1.0
Biotechnology	40	6	46	-0-
Miscellaneous	72	10	82	-0-
<b>Total</b>	<b>2,043</b>	<b>273</b>	<b>2,316</b>	<b>7.0</b>
<b>Maize</b>				
CIDA/Ghana	646	111	757	2.0
CIDA/E.Africa	372	55	427	2.0
USAID/Pakistan	389	27	416	1.0
USAID/E.Africa	200	30	230	1.0
Switz./Seed	255	45	300	1.0
<b>Total</b>	<b>1,862</b>	<b>268</b>	<b>2,130</b>	<b>7.0</b>
<b>Economics</b>				
CIDA/Haiti	225	33	258	2.0
USAID/E. & S.Africa	450	68	518	3.0
USAID/Pakistan	142	13	155	-0-
<b>Total</b>	<b>817</b>	<b>114</b>	<b>931</b>	<b>5.0</b>
<b>Others</b>				
IDRC/SIU	83	10	93	-0-
<b>Total</b>	<b>4,805</b>	<b>665</b>	<b>5,470</b>	<b>19.0</b>

## 1987 Budget Request

### Financial Planning

Planning figures from the CGIAR Secretariat indicate an overall inflation/exchange rate of 7%, and CIMMYT has adopted this rate in planning its 1987 programs. The implication of this choice is an estimated 3-4% OECD or US rate of inflation and a 10-12% dollar-denominated inflation in Mexico. Past experience indicates that inflation rates in Mexico have been high (60-100% p.a.) and in recent years have frequently been accompanied by currency devaluations. Since continued high rates of inflation are likely in Mexico in 1987, the timing and magnitude of any change in the value of the currency will be of great importance in evaluating CIMMYT's financial requirements during the year.

The stabilization fund is intended to remove much of the guesswork about inflation and exchange rates that results from making such predictions one to two years in advance. Under this set of operating procedures, adjustments for inflation and exchange rates can be made just prior to, or even during, the operating year. This should help CIMMYT forecast its financial needs in a timely manner, with greater accuracy.

In light of this economic situation, the 7% figure assumed by CIMMYT is the likely minimum amount required for 1987; any amount greater than that would be considered a drawdown on the stabilization fund. This arrangement has two advantages:

- It signals to the CGIAR CIMMYT's minimum requirements and thereby assists in planning at the System level, and
- Moving inflation and exchange rate planning closer to the operating year in question will probably result in a more realistic operating budget for CIMMYT, one which is less subject to fluctuations in inflation and exchange rate.

### Planning Program Changes

At the beginning of this document, the relationship between CIMMYT and the CGIAR was described, focusing on the objectives of the CGIAR and the intermediate products provided by CIMMYT in response to international research and training needs. CIMMYT's primary clients are national agricultural research systems, and the Center provides five intermediate goods to these clients: improved germplasm, trained people, procedures, counsel, and information.

The Center's emphasis on assessing and responding to research and training needs helps formulate appropriate program plans and activities. In recent years, for example, CIMMYT has made important additions to its maize germplasm bank. This activity arose from the Center's interest in addressing larger concerns about genetic resources and providing greater sources of genetic variability to national programs. As a result, CIMMYT made improvements to its bank facility, and strengthened its maize germplasm collection, classification, and evaluation work. In wheat, another type of response was given to international research needs with the establishment of the barley yellow dwarf project. In that case, information exchange was identified as important; hence the project has a strong networking and collaborative orientation with other institutions.

### Core Programs

The CGIAR recently completed two studies that will have an important role in determining the future direction of international agricultural research. One of these documents, the Impact Study, focused on the past and likely future achievements of the CGIAR. A second document, the TAC Study of Priorities, exclusively addresses the future research and training agenda of the CGIAR. In these documents and in subsequent discussions, wheat and maize were judged to have an important long-term role in future international research and training activities supported by the CGIAR.

For 1987, the Wheat Program plans no change in international staff or shifts in program emphasis. The Impact Study and the discussions on priorities both pointed out the important contributions of the CIMMYT Wheat Program and noted the need for continuing research. Maintenance research, marginal environments, genetic variability, yield dependability, crop management research, and collaborative programs were all cited as important areas that ought to continue to receive significant resources. These activities have received increasing attention in recent years—the tropical wheat program and collaborative efforts with Brazil and Turkey are but two examples—and will continue to do so in 1987.

After two years of steady increases in staff and funds, the Maize Program plans no major changes in 1987. Rather, the Program seeks to consolidate its efforts. At headquarters, for example, germplasm development and improvement now cover hybrids, quality protein maize, highland areas, research on stress, and pool and population management. This work, in combination with the breeding program for midaltitude areas, based in Zimbabwe, will cover the range of mega- and macro-environments that the maize program seeks to address.

Regional programs will also be fully staffed in 1987, and no additional personnel are sought. These programs have three principal objectives;

- To assist national agricultural research systems in certain aspects of the design and implementation of research programs;
- To help identify needs for CIMMYT's products and services at the regional and national level; and
- To facilitate the use of these products by coordinating and collaborating with national programs.

The Economics Program, in 1985, signed an extension of an extra-core grant for training, networking, and institutional collaboration in Eastern and Southern Africa. This grant, which supports the work of three economists and one maize agronomist, will be an important part of CIMMYT's efforts in the region through 1990. Other similar programs are underway in Haiti and Pakistan.

Core activities at headquarters and in the regions are programmed at the same level in 1987 as in 1986, and will continue to emphasize studies on the allocation of research resources, procedures, and data generation and analysis.

Though CIMMYT's three research programs plan no major changes in 1987, a number of important additions are scheduled. These cover research support and training fellowships. In research support, two new initiatives are planned: one, in experiment stations, seeks to develop closer links with national programs; a second adds a biotechnology component to support maize and wheat research. In training, CIMMYT seeks to provide more visiting scientist fellowships and a new focus for some participants.

Of the highest priority for CIMMYT in 1987 is the addition of a molecular geneticist to enhance work in the biotechnology research support unit. The need for such emphasis was expressed in the TAC priorities study and in subsequent discussions at Bellagio. In response, CIMMYT intends to augment its small biotechnology research support unit, and will include work on molecular genetics and maize and wheat wide crosses. The primary purpose in adding this staff member is to stay abreast of new developments in this rapidly changing field; thus, when techniques appropriate to CIMMYT's needs are identified, the Center will be able to adopt them with greater ease.

In experiment stations, plans call for an additional 1.0 man year to bring to three the number of international staff in this area. The primary objective of this addition is to expand CIMMYT's capacity to work closely with national programs in experiment station development and management. This activity should increase current institutional collaboration and will provide support to germplasm and crop management research in regional and national programs.

Additional training funds are requested to support 10-15 senior visiting scientists during 1987 as part of CIMMYT's effort to widen the range of training opportunities it offers. These senior fellowships will permit CIMMYT to work closely with researchers from well developed national programs and will benefit all parties. This, too, is a response to recent studies in the CGIAR that have called upon the centers to find a greater variety of ways to work with national programs. Table 8 summarizes 1987's projected core expenses.

### **Extra-Core Programs**

CIMMYT plans to continue current extra-core programs in 1987. This involves 19.0 man years of international staff assigned to these projects, with likely expenditures of \$5.0 million (not including administrative fees). Because some grants are due for renegotiation and others have carryforward provisions, the exact level of funding for 1987 will not be known until late 1986.

### **Summary**

Given current projections, the total budget for CIMMYT for 1987 will be \$30,128,000. Of this amount, \$24,928,000 will be for core and the remainder for extra-core activities. The core budget represents a growth of 9% over the 1985 funding level (i.e., 96% of approved budget); of this amount, 7% is absorbed by inflation and exchange rate changes, and the remainder by staff increases. The extra-core budget shows no alterations from 1986, except for inflation and exchange rate changes built into agreed contracts.

Total staff for 1987 are projected to reach 106.0 man years. Core programs account for 87.0 man years of this total. This represents an increase of 2.0 man years over 1986: 1.0 man year for Experiment Stations and 1.0 man year for Biotechnology. Extra-core grants show no change from 1986.

Tables 9 and 10 summarize the total budget and staffing pattern for 1987.

**Table 8. Core summary, 1985-1987 (US Dollars, Thousands)**

	1985 Actual		1986 Budget		1987 Request <sup>1/</sup>	
	Cost	Man Years	Cost	Man Years	Cost	Man Years
Research						
Wheat	5,336	25.0	5,200	26.0	5,200	26.0
Maize	4,915	25.5	5,456	29.0	5,456	29.0
Economics	870	5.75	1,093	6.0	1,093	6.0
Sub-Total	11,121	56.25	11,749	61.0	11,749	61.0
Research Support						
Labs	526	2.5	616	2.0	616	2.0
Biotechnology	-0-	-0-	-0-	-0-	150	1.0
Exp. Stations	1,530	2.0	1,823	2.0	1,973	3.0
Data Processing	697	2.0	750	2.0	750	2.0
Sub-Total	2,753	6.5	3,189	6.0	3,489	8.0
Total Research	13,874	62.75	14,938	67.0	15,238	69.0
Training and Conferences	2,966	8.5	3,188	9.0	3,325	9.0
Information	905	3.0	875	3.0	875	3.0
General Administration	1,783	5.25	2,000	6.0	2,000	6.0
Plant Operations	1,464	-0-	1,840	-0-	1,840	-0-
Total Programs	20,992	79.5	22,841	85.0	23,278	87.0
Contingency	-0-	-0-	614	-0-	-0-	-0-
Inflation/Exchange	-0-	-0-	-0-	-0-	1,600	-0-
Capital and Translation <sup>2/</sup>	444	-0-	50	-0-	50	-0-
Grand Total CIMMYT	21,436	79.5	23,505	85.0	24,928	87.0

1/ 1986 dollars down to line "Total Programs"

2/ Translation is the expense arising from the change in value in net assets due to currency fluctuations

**Table 9. 1987 Financial summary (US Dollars, Thousands)**

	1986 Budget			1987 Budget		
	Core	Extra Core	Total	Core	Extra Core	Total
<b>Sources</b>						
Grants	22,526	4,805	27,331	23,765	5,200	28,965
Admin. Fees	604		604	788		788
Sale of Crops, etc.	350		350	350		350
Interest Income	25		25	25		25
<b>Total Sources</b>	<b>23,505</b>	<b>4,805</b>	<b>28,310</b>	<b>24,928</b>	<b>5,200</b>	<b>30,128</b>
<b>Uses</b>						
<b>Research</b>						
Wheat	5,200	1,589	6,789	5,200	1,720	6,920
Maize	5,456	1,478	6,934	5,456	1,608	7,064
Economics	1,093	677	1,770	1,093	760	1,853
<b>Sub-Total</b>	<b>11,749</b>	<b>3,744</b>	<b>15,493</b>	<b>11,749</b>	<b>4,088</b>	<b>15,837</b>
<b>Research Support</b>						
Labs	616		616	616		616
Exp. Stations	1,823		1,823	1,973		1,973
Data Processing	750		750	750		750
Biotechnology	-0-		-0-	150		150
<b>Sub-Total</b>	<b>3,189</b>		<b>3,189</b>	<b>3,489</b>		<b>3,489</b>
<b>Training</b>						
Information	3,188	978	4,166	3,325	1,027	4,352
General Administration	875	83	958	875	85	960
Plant Operations	2,000		2,000	2,000		2,000
<b>Total Programs</b>	<b>1,840</b>		<b>1,840</b>	<b>1,840</b>		<b>1,840</b>
<b>Total Programs</b>	<b>22,841</b>	<b>4,805</b>	<b>27,646</b>	<b>23,278</b>	<b>5,200</b>	<b>28,478</b>
<b>Capital</b>						
Contingency	50		50	50		50
Inflation/Exchange	614		614	-0-		-0-
<b>Total Uses</b>	<b>-0-</b>	<b>4,805</b>	<b>-0-</b>	<b>1,600</b>	<b>5,200</b>	<b>1,600</b>
<b>Total Uses</b>	<b>23,505</b>	<b>4,805</b>	<b>28,310</b>	<b>24,928</b>	<b>5,200</b>	<b>30,128</b>
<b>Balance</b>	<b>-0-</b>	<b>-0-</b>	<b>-0-</b>	<b>-0-</b>	<b>-0-</b>	<b>-0-</b>



**Table 10. International staff, 1985-1987**

	1985 Actual			1986 Budget			1987 Request		
	Core	Extra Core	Total	Core	Extra Core	Total	Core	Extra Core	Total
<b>Wheat</b>									
Headquarters	14.5	1.0	15.5	15.5	1.0	16.0	16.0	1.0	17.0
Regional Programs	10.5	1.0	11.5	10.5	1.0	11.5	10.0	1.0	11.0
National Programs	-0-	5.0	5.0	-0-	5.0	5.0	-0-	5.0	5.0
Sub-Total	25.0	7.0	32.0	26.0	7.0	33.0	26.0	7.0	33.0
<b>Maize</b>									
Headquarters	12.5	-0-	12.5	14.0	-0-	14.0	14.0	-0-	14.0
Regional Programs	13.0	3.0	16.0	15.0	5.0	20.0	15.0	5.0	20.0
National Programs	-0-	3.0	3.0	-0-	3.0	3.0	-0-	3.0	3.0
Sub-Total	25.5	6.0	31.5	29.0	8.0	37.0	29.0	8.0	37.0
<b>Economics</b>									
Headquarters	1.75	-0-	1.75	2.0	-0-	2.0	2.0	-0-	2.0
Regional Programs	4.0	2.0	6.0	4.0	3.0	7.0	4.0	3.0	7.0
National Programs	-0-	1.0	1.0	-0-	1.0	1.0	-0-	1.0	1.0
Sub-Total	5.75	3.0	8.75	6.0	4.0	10.0	6.0	4.0	10.0
<b>Research Support</b>	6.5	-0-	6.5	6.0	-0-	6.0	8.0	-0-	8.0
<b>Training and Conferences</b>	8.5	-0-	8.5	9.0	-0-	9.0	9.0	-0-	9.0
<b>Information Services</b>	3.0	-0-	3.0	3.0	-0-	3.0	3.0	-0-	3.0
<b>General Admin. &amp; Plant Operations</b>	5.25	-0-	5.25	6.0	-0-	6.0	6.0	-0-	6.0
<b>Total Headquarters</b>	43.5	1.0	44.5	46.5	1.0	47.5	49.0	1.0	50.0
<b>Total Regional Programs</b>	27.5	6.0	33.5	29.5	9.0	38.5	29.0	9.0	28.0
<b>Total National Programs</b>	-0-	9.0	9.0	-0-	9.0	9.0	-0-	9.0	9.0
<b>Total Training</b>	8.5	-0-	8.5	9.0	-0-	9.0	9.0	-0-	9.0
<b>Grand Total CIMMYT</b>	79.5	16.0	95.5	85.0	19.0	104.0	87.0	19.0	106.0

## Budget Tables

### Notes to the Budget Tables

The accompanying budget tables are required as part of the budget submission to the CGIAR. The information contained therein and the format are prescribed by the CGIAR Secretariat.

Table 1. Summary of core international staff years and operating costs by activity, 1984-1987

This table shows international staff man-years and the total cost of the Center's operations broken down by major core programs. Line items 1-6 describe program operations in constant dollars from the base year onward; thus the 1987 request is shown in constant 1986 dollars with the total given in Line 6. Line 7 gives inflation and exchange rates, as appropriate, compounded from 1987 onward. The total amount for core in current dollars is given in Line 8; it is the sum of Lines 6 and 7. Line 9 shows actual and estimated extra-core grants. The purpose of this line is to demonstrate the degree of balance between core and extra-core funds. Line 10 is a completely different breakdown, done by object of expenditure, rather than by program.

Table 2. Summary of sources and uses of funds, 1984-1987

As the title suggests, this table describes sources and uses of funds for the Center. It shows total funds (not just cash) on hand at the start of the year, broken down by source, and describes their application to various programs (core, extra core), capital, and unexpended fund balances during the year. It is similar to an income statement (or statement of financial activity). Total sources and total uses of funds should always be equal;

gains or losses that are normally shown on the "bottom line" of an income statement are treated as additions to or subtractions from unexpended funds of this statement. This table is shown in current dollars.

Table 3. Net requirement from CGIAR, 1984-1987

This table shows total funds required each year, broken down by programs and capital. Any funds on hand (such as the balance in unexpended funds) or estimated income to be earned during the year (e.g., income from short-term investments) are subtracted from the total required to give the net amount of cash that donors must provide CIMMYT (assuming a fully funded budget). The sum of this across centers gives the total net requirement for those institutions funded by the CGIAR. This table is shown in current dollars.

Table 4. Summary balance sheet, 1984-1987

These are notional figures of assets and liabilities. Figures for past years are from the Center's independently audited financial statement. The tables mainly provide a check and planning figure for balances in the Capital Grants, Unexpended Funds, and Reserves (Net Worth) section of the balance sheet. Figures for current assets and liabilities are estimates only. This table is shown in current dollars.

Table 5. Capital expenditures, 1984-1987

In an established center such as CIMMYT, capital expenditures are usually a small portion of total budget. Major items are capital acquisitions (new rather than replacement items) and additions to operating funds. In 1984 and 1985, the translation effect was charged here. This table is shown in current dollars.

**Table 1. Summary of core international staff years and operating costs by activity, 1984-1987  
(US Dollars, Thousands)<sup>1/</sup>**

	1984 Actual		1985 Actual		1986 Current Estimate		1987 Request	
	Cost	My*	Cost	My	Cost	My	Cost	My
<b>Research</b>								
Wheat Program								
Bread Wheat	325	1.0	260	1.0	288	1.0	288	1.0
Durum Wheat	142	1.0	136	1.0	139	1.0	139	1.0
Barley	170	0.75	51	-0-	48	-0-	48	-0-
Triticale	194	1.0	229	1.0	255	1.0	255	1.0
Tropical Wheat	319	2.0	299	2.0	347	2.0	347	2.0
Regional Programs	1,507	9.5	1,512	10.5	1,695	10.5	1,695	10.0
Research and Mgmt. Support	3,186	10.25	2,849	9.5	2,428	10.5	2,428	11.0
Sub-Total Wheat	5,843	25.5	5,336	25.0	5,200	26.0	5,200	26.0
Maize Program								
Improvement	1,110	7.5	1,496	8.0	1,650	9.0	1,650	9.0
Regional Programs	1,857	11.75	1,780	13.0	2,003	15.0	2,003	15.0
Research and Mgmt. Support	1,315	4.0	1,639	4.5	1,803	5.0	1,803	5.0
Sub-Total Maize	4,282	23.25	4,915	25.5	5,456	29.0	5,456	29.0
Economics Program								
Headquarters	379	1.5	425	1.75	424	2.0	425	2.0
Regional Programs	581	4.0	445	4.0	669	4.0	668	4.0
Sub-Total Economics	960	5.5	870	5.75	1,093	6.0	1,093	6.0
Research Support								
Laboratory Services	526	2.0	526	2.0	616	2.0	616	2.0
Seed Health	-0-	-0-	-0-	0.5	-0-	-0-	-0-	-0-
Biotechnology	-0-	-0-	-0-	-0-	-0-	-0-	150	1.0
Experiment Stations	1,453	2.0	1,530	2.0	1,823	2.0	1,973	3.0
Data Processing	764	2.75	697	2.0	750	2.0	750	2.0
Sub-Total Research Support	2,743	6.75	2,753	6.5	3,189	6.0	3,489	8.0
Training and Conferences	2,721	7.25	2,966	8.5	3,188	9.0	3,325	9.0
Information Services	789	3.0	905	3.0	875	3.0	875	3.0
General Administration	1,504	6.0	1,783	5.25	2,000	6.0	2,000	6.0
Plant Operations	1,475	-0-	1,464	-0-	1,840	-0-	1,840	-0-
Sub-Total Programs <sup>1/</sup>	20,317	77.25	20,992	79.5	22,841	85.0	23,278	87.0
Other								
Contingency <sup>2/</sup>	-0-	-0-	-0-	-0-	614	-0-	-0-	-0-
Nominal Increment <sup>3/</sup>	-0-	-0-	-0-	-0-	-0-	-0-	1,600	-0-
Total Core	20,317	77.25	20,992	79.5	23,455	85.0	24,878	87.0
Total Extra Core <sup>4/</sup>	3,434	13.0	3,447	16.0	4,605	19.0	5,200	19.0
By Object of Expenditure								
Salaries and Allowances	9,504	-0-	9,725	-0-	10,889	-0-	11,100	-0-
Supplies and Services	7,635	-0-	7,767	-0-	8,687	-0-	8,434	-0-
Fellowships	1,775	-0-	1,904	-0-	2,131	-0-	2,250	-0-
Travel	1,403	-0-	1,596	-0-	1,738	-0-	1,494	-0-
Total <sup>5/</sup>	20,317	77.25	20,992	79.5	23,455	85.0	23,278	87.0

1/ 1984-1985 in nominal dollars throughout; 1986-1987 in 1986 dollars Lines 1-6; line 7 in nominal dollars.

2/ Equals 1% of program total, except in 1986 when it equals possible funding short fall.

3/ The combined effect of inflation and exchange rates from 1986 onward: 7% p.a.

4/ Estimates for 1986 onward. Amounts are exclusive of administrative fees.

5/ In 1986 dollars from 1986 onward. Total equals core programs plus contingency.

\* My = Man years

**Table 2. Summary of sources and uses of funds, 1984-1987  
(US Nominal Dollars, Thousands)**

	1984 Actual	1985 Actual	1986 Current Estimate	1987 Request
<b>Sources of Funds</b>				
<b>Core Operations</b>				
Unrestricted Grants	14,939	15,570	18,026	19,065
Restricted Grants	4,889	4,697	4,500	4,700
Earned Income Applied in Year	975	857	979	1,163
Unexpended Balances-Core	69	(230)	(542)	(542)
Sub-Total	20,872	20,894	22,963	24,386
<b>Capital and Reserves</b>				
Grants	-0-	-0-	-0-	-0-
Unexpended Balances	-0-	-0-	-0-	-0-
Balance in Operating Funds	1,540	1,540	1,540	1,540
Sub-Total	1,540	1,540	1,540	1,540
<b>Extra Core Operations</b>				
Extra-Core Grants	3,434	3,447	4,805	5,200
Unexpended Balances	(48)	(48)	(48)	(48)
Sub-Total	3,386	3,399	4,757	4,952
<b>Total Sources of Funds</b>	<b>25,798</b>	<b>25,833</b>	<b>29,260</b>	<b>31,078</b>
<b>Uses of Funds</b>				
<b>Core Operations</b>	<b>20,317</b>	<b>20,992</b>	<b>23,455</b>	<b>24,878</b>
<b>Capital and Reserves</b>	<b>785</b>	<b>444</b>	<b>50</b>	<b>50</b>
<b>Extra-Core Projects</b>	<b>3,434</b>	<b>3,447</b>	<b>4,805</b>	<b>5,200</b>
<b>Unexpended Funds</b>				
Core	(230)	(542)	(542)	(542)
Extra Core	(48)	(48)	(48)	(48)
Operating Funds	1,540	1,540	1,540	1,540
Sub-Total	1,262	950	950	950
<b>Total Uses of Funds</b>	<b>25,798</b>	<b>25,833</b>	<b>29,260</b>	<b>31,078</b>

**Table 3. Net requirements from CGIAR, 1984-1987  
(US Nominal Dollars, Thousands)**

	1984 Actual	1985 Actual	1986 Current Estimate	1987 Request
<b>Total Core Operating Funds Required</b>	20,317	20,992	23,455	24,878
Less: Unexpended Funds Balance	69	(230)	(542)	-0-
Less: Earned Income (excepting administrative fees on Core Restricted Grants)	975	857	875	875
<b>Net Core Operating Funds Required from CGIAR</b>	19,273	20,365	23,122	24,003
<b>Total Capital Funds Required</b>	2,325	1,984	1,590	1,590
Less: Balance of Operating Funds Previous Year	1,540	1,540	1,540	1,540
<b>Net Capital Funds Required from CGIAR</b>	785	444	50	50
<b>Net Funds Required from CGIAR</b>	20,058	20,809	23,172	24,053
<b>Net Funds Received from CGIAR</b>	19,828	20,267	N/A	N/A
<b>Balance Carried Forward</b>	(230)	(542)	N/A	N/A

**Table 4. Summary balance sheet, 1984-1987**  
**(US Nominal Dollars, Thousands)**

	1984 Actual	1985 Actual	1986 Current Estimate	1987 Request
<b>Current Assets</b>				
Cash	791	399	300	300
Short Term Investments	2,867	5,288	5,300	6,300
Receivables (Donors)	1,437	1,130	1,100	1,100
Receivables (Others)	429	744	700	700
Inventories	213	88	99	99
Prepaid Expenses	-0-	-0-	-0-	-0-
Other Current Assets	-0-	-0-	-0-	-0-
<b>Total Current Assets</b>	<b>5,737</b>	<b>7,649</b>	<b>7,499</b>	<b>8,499</b>
<b>Fixed Assets</b>				
Vehicles	2,906	3,245	3,400	3,500
Furnishing and Equipment	4,169	5,323	5,500	5,800
Buildings	6,356	7,257	7,765	7,865
Land	464	464	464	464
Other Fixed	369	369	371	371
<b>Total Fixed Assets</b>	<b>14,264</b>	<b>16,658</b>	<b>17,500</b>	<b>18,000</b>
<b>Other Assets</b>	<b>10</b>	<b>1</b>	<b>1</b>	<b>1</b>
<b>Total Assets</b>	<b>20,011</b>	<b>24,308</b>	<b>25,000</b>	<b>26,500</b>
<b>Liabilities</b>				
Accounts Payable	2,705	1,793	2,011	2,511
Other Liabilities	386	459	600	600
Payments in Advance - Donors	1,549	4,509	4,000	4,500
<b>Total Liabilities</b>	<b>4,640</b>	<b>6,761</b>	<b>6,611</b>	<b>7,611</b>
<b>Fund Balances</b>				
Capital	14,264	16,658	17,500	18,000
Fully Expended in Fixed Assets	1,540	1,540	1,540	1,540
Operating Funds				
Unexpended Funds (Including Translation Effect)	(525)	(743)	(743)	(743)
Trustee Reserve	92	92	92	92
<b>Total Fund Balances</b>	<b>15,371</b>	<b>17,547</b>	<b>18,389</b>	<b>18,889</b>
<b>Total Equity</b>	<b>20,011</b>	<b>24,308</b>	<b>25,000</b>	<b>26,500</b>

**Table 5. Capital expenditures, 1984-1987  
(US Nominal Dollars, Thousands)**

	1984 Actual	1985 Actual	1986 Current Estimate	1987 Request
<b>Capital</b>				
Acquisitons and Improvements	432	96	-0-	-0-
Operating Funds	-0-	-0-	-0-	-0-
Seniority Premiums	50	36	50	50
Translation Effect <sup>1/</sup>	303	312	-0-	-0-
<b>Total Capital</b>	<b>785</b>	<b>444</b>	<b>50</b>	<b>50</b>

<sup>1/</sup> Translation effect charged to current year's operation in accordance with Statement 52 of the Financial Accounting Standards Board of the United States.



## Notes



CENTRO INTERNACIONAL DE MEJORAMIENTO DE MAIZ Y TRIGO  
INTERNATIONAL MAIZE AND WHEAT IMPROVEMENT CENTER  
Lisboa 27 Apartado Postal 6-641 06600 México, D.F., México