MTP 2006-2008

CIMMYT Building on Strength

International Crop Improvement: Our contribution to reduce hunger and poverty

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CIMMYT® (www.cimmyt.org) is an internationally funded, not-for-profit organization that conducts research and training related to maize and wheat throughout the developing world. Drawing on strong science and effective partnerships, CIMMYT works to create, share, and use knowledge and technology to increase food security, improve the productivity and profitability of farming systems, and sustain natural resources. Financial support for CIMMYT's work comes from many sources, including the members of the Consultative Group on International Agricultural Research (CGIAR) (www.cgiar.org), national governments, foundations, development banks, and other public and private agencies.

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Introduction and Context

In 2003 CIMMYT began a process of renewal and revitalization. It was designed to keep CIMMYT's crucial maize and wheat improvement work relevant to the needs of the poorest and those in fragile environments, where the options and opportunities for a better life are still very limited. This process of change has refocused CIMMYT, bringing it back to its original roots: international crop improvement for the alleviation of hunger and poverty.

CIMMYT's core strength and its roots: International crop improvement
In 1970, accepting the only Nobel Peace Prize ever given for work in agriculture, Dr Norman Borlaug referred to his "army of hunger fighters." He didn't talk about breeders. He didn't talk about process. He focused on the outcomes that his good science had produced—not yield potential, varieties released or hectares planted—but the reduction of global hunger. Wheat and maize improvement meant something only if it led directly to food security improvement and with that a reduction in poverty.

Years later, Dr Borlaug still held that basic tenet of development, saying, "For more than half a century I have worked with the production of more and better wheat for feeding the hungry people, but wheat is merely a catalyst, a part of the picture. I am interested in the total development of human beings."

To fulfill this vision of improving the livelihoods of the poor and hungry, Dr Borlaug established the centralized breeding, seed production and international distribution system which was the delivery mechanism for the improved varieties of the Green Revolution. The improved germplasm and knowledge in relation to the germplasm and cultivation practices (typical examples of global public goods) were shared world-wide through the participation of many national and regional organizations. CIMMYT played a pivotal role in the global effort to improve staple crops. While we take the process for granted to day, at the time it was revolutionary. Most importantly it had huge impact on the lives of people, especially those in the areas of the world where intensive farming on irrigated land with access to inputs was possible.

CIMMYT: repositioning for a changing world
While CIMMYT and our partners have made a huge mark in the high-potential maize and wheat growing parts of the world (e.g. the Indo-Gangetic plane), many other areas where maize and wheat are food staples, have yet to benefit from the power of the research work that CIMMYT has done. Both socio-economic and agronomic conditions in many parts of the world require innovative approaches. Often the small size of land holdings, lack of access to credit or less favorable environments dominated by severe abiotic constraints (e.g. lack of dependable water, or a short growing season, low soil fertility) mean developing more local solutions for wheat or maize production systems to yield more value. Often these communities have very specific needs in their cropping systems that have yet to be addressed in a systematic way. Socioeconomic development led by sustainable productivity increases is essential for those who live in these marginal areas. This is where CIMMYT's global reach can be sharply focused at the more local level. Identifying the most effective impact pathways is vital to this process and working with the appropriate partners who can deliver the impact potential is crucial.

In maize and wheat farming systems, if CIMMYT is to fully do its part in helping meet the first United Nations Millennium Development Goal (MDG), halving poverty and hunger by 2015, then it

must work to improve livelihoods in the world's less endowed maize and wheat environments as well as in the more intensively farmed areas of the developing world. That requires harnessing all the potential, not only of classical maize and wheat breeding but also of new biotechnological tools, integrated with knowledge of farming systems and the people who farm.

Impact involves more than breeding. Most small-holder farmers do not depend on single crops or even on crops alone. They intercrop, raise livestock, and sometimes even fish. This helps spread their risk and manage better their scarce resources. For example in eastern and southern Africa, maize is nearly always grown as part of a complex system that also involves livestock. By working at the farming system level, CIMMYT can target its crop breeding to meet real needs. Sometimes a farmer will accept a tradeoff in grain yield if it means more stover for animal feed. Also, while yield potential is traditionally the first trait a breeder seeks, yield stability or eating quality may be the traits farmers value most in a vulnerable environment. Understanding these complex systems in regions, where input-driven crop management is not possible, is vital if CIMMYT is to deliver technologies farmers can and will use. Further, even in high potential areas, successful adoption of resource conserving technologies—such as zero-tillage—might require new genotypes.

CIMMYT Strategic Goals

CIMMYT's agenda for change may also be looked at in terms of a set of strategic goals. Those strategic goals have been developed through careful analysis and with extensive consultation in 2004. Each of these goals is outcome-oriented, always keeping in mind the resource poor that it is our mission to serve.

- **Saving and studying maize and wheat genetic diversity for humanity.**
  CIMMYT takes the maintenance and improvement of the genebank that holds in-trust collections of maize and wheat very seriously. Continuing genetic resources studies will add value to the collections. This includes extensive pre-breeding work to transfer specific traits into forms ready for breeding.
- **Developing and delivering better maize and wheat germplasm faster.**
  We must meet the real needs of our most important clients so that our work can result in adoption by farmers. That means breeding for yield potential, stability, stress tolerance, nutritional enhancement, input use efficiency and other valuable traits farmers may need.
- **Delivering better cropping practices for maize and wheat systems.**
  Our work in resource conserving technologies is already well-known. We will continue research into enhanced technologies farmers in our target regions can use and that will work hand in hand with the outputs of our breeding initiatives.
- **Enhancing the capacity of our partners and networks.**
  This will lead to more effective delivery and utilization of the products and technologies that CIMMYT produces. This includes capacity building, knowledge management, the facilitation of knowledge networks and the fostering of innovation systems.

What are the evolutionary changes?

Maize and wheat are two of the three most important food crops for the developing world. The work CIMMYT does with these crops and the farming systems that grow them is so important to those who live in the less advantaged parts of the world—those who for now the developed world has left behind—that we cannot afford to fail.

The Importance of Maize and Wheat in the Developing world

- Maize and wheat are two of the three principal food crops in the world
- In developing countries maize and wheat account for 40% of the food and 25% of the calories people consume
- Maize and wheat currently occupy about 200 million hectares or 44% of agricultural land in developing countries
- Current estimates (IFPRI) are that developing countries will have to increase wheat production by 1.3% per year to meet demand and do it on the same land base; similarly for maize, developing country demand will increase by more than 2% per year

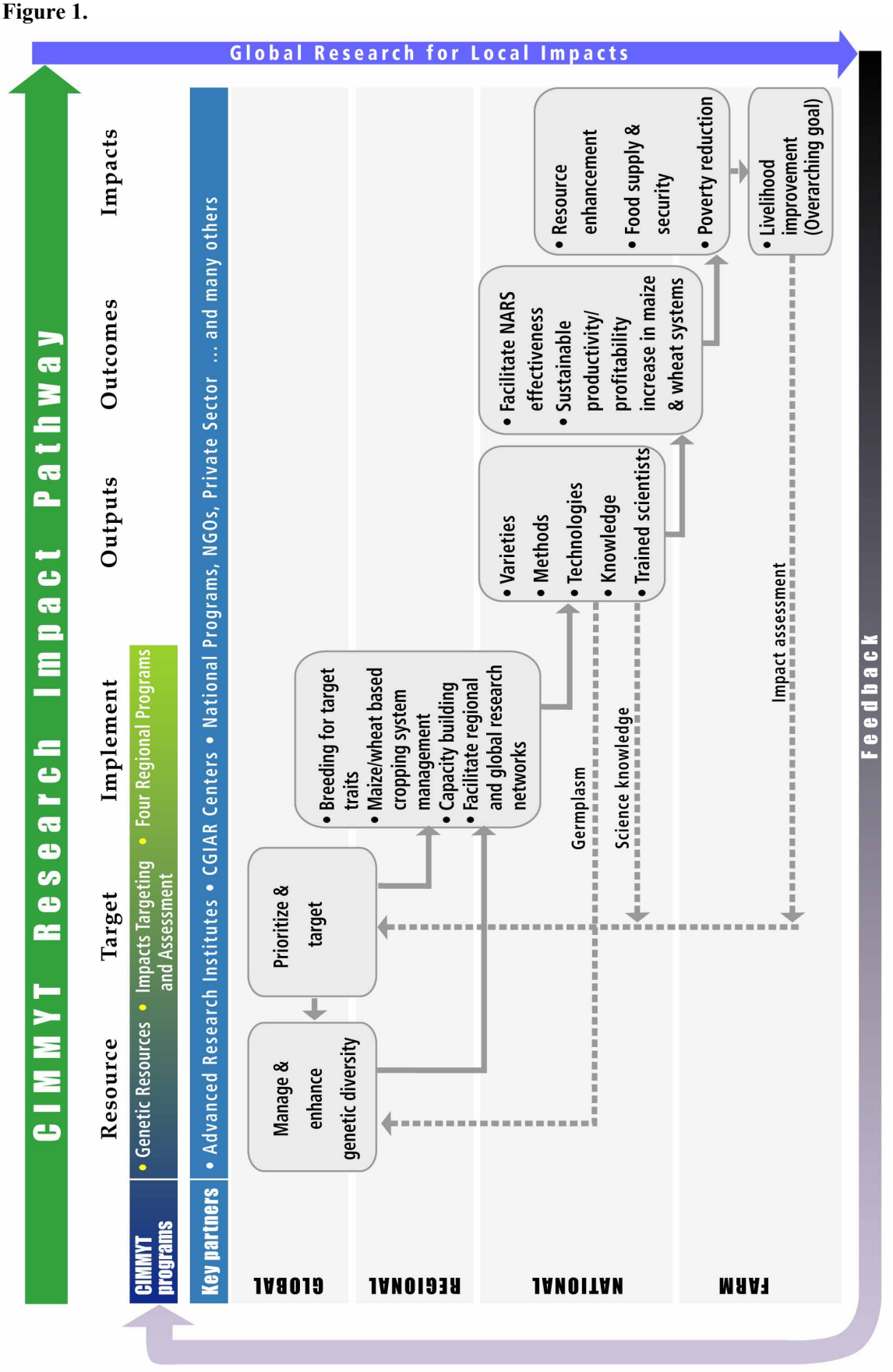
For CIMMYT, 2004 was the year of transition, starting the implementation of the new strategic plan "Seeds of Innovation," which positioned CIMMYT as the world's premiere maize and wheat research center for the improvement of food security and the reduction of hunger and malnutrition. The process by which the plan was crafted was participatory in every way. CIMMYT asked for and received valuable input from all its development investors (donors) and partners as well as other stakeholders, and from its own scientific and non-scientific staff. CIMMYT listened.

CIMMYT is a global research institute and has global coverage due to the importance of maize and wheat in many parts of the world. But as the environmental movement constantly reminds us, the best way is to think globally but act locally. That is why the current CIMMYT research agenda has both global and local components and why we have a program structure that reflects global and regional priorities.

There is no doubt that refocusing CIMMYT in a time of extreme financial constraint resulted in some reduction in traditional breeding strength. To increase strength in other areas vital to the effective operation of the plan, but where CIMMYT was not as strong as it needed to be, meant downsizing in other areas. Although there have been some cuts in plant breeding, CIMMYT recognizes that such work must continue and advance (for example with research to find new, durable rust resistance in order to mitigate the potential impact of a resurgence of dangerous leaf and stem rusts).

The sharper research focus required some reorientation in thinking about how we go about our research work. For example, CIMMYT breeding programs are enhanced by knowledge of the relevant impact pathways. This is strategic breeding to maximize impact. More broadly, within the context of Science Council and MDG goals, the CIMMYT impact pathway leads from our most valuable resource, maize and wheat germplasm, to poverty reduction for poor rural households. Along the way, priority setting and targeting focuses crop improvement and technology development activities on traits and problems in order to give maximum impact. Regional programs work closely with national programs (NARS) to develop and test varieties and technologies, improve knowledge and train scientists. Feedback loops from each stage fine tune the targeting and priority setting and add to our resource base of germplasm and knowledge (see Figure 1).

Figure 1.


CIMMYT Research Impact Pathway
Global Research for Local Impacts
Resource
Target
Implement
Outputs
Outcomes
Impacts
CIMMYT programs
• Genetic Resources • Impacts Targeting and Assessment • Four Regional Programs
Key partners
• Advanced Research Institutes • CGIAR Centers • National Programs, NGOs, Private Sector ... and many others
GLOBAL
REGIONAL
NATIONAL
FARM
Manage & enhance genetic diversity
Prioritize & target
• Breeding for target traits
• Maize/wheat based cropping system management
• Capacity building
• Facilitate regional and global research networks
• Varieties
• Methods
• Technologies
• Knowledge
• Trained scientists
• Facilitate NARS effectiveness
• Sustainable productivity/ profitability increase in maize & wheat systems
• Resource enhancement
• Food supply & security
• Poverty reduction
• Livelihood improvement (Overarching goal)
Germplasm
Science knowledge
Impact assessment
Feedback

There are several key emphases in our new, strategic, genetic enhancement:

- Genetic resources
  We must make the best use of the vast and as yet largely untapped genetic diversity we have in our maize and wheat collections, including wild relatives.
- Germplasm enhancement
  While we have always done this, now we are looking to the development of specialized genetic stocks, parental lines, and populations rather than finished varieties. We will do more efficient field-oriented crop improvement with a better balance between centralized and decentralized breeding approaches. We will also better integrate new genetic enhancement tools into our breeding programs
- Knowledge
  CIMMYT has always contributed to the growing global knowledge base for maize and wheat germplasm. We will, of course, continue to take a leading role in this area. More than that, we can now begin to tap the knowledge in new ways to enhance and make more efficient our breeding approaches
- Working with users/ beneficiaries to set objectives and priorities
  In many of the environments we are targeting, local knowledge and needs will form an important component in our planning for crop enhancement. This is part of the impact pathway approach
- Global networks
  Enhancing and fostering global networks will help us mobilize external expertise when needed. For example, our current work includes the Fusarium Head Blight and Global Rust Initiatives

CIMMYT and CGIAR Science Council Priorities (refer to Table 2)
CIMMYT's current research agenda and its 25 major outputs fit very well with the new set of research priorities identified by the CGIAR Science Council. We have already referred to many of these in this document. Our work in genetic resources conservation for maize, wheat, and their wild relatives in the Genetic Resource Program, our breeding work that is a vital component of our region-based programs, our policy work through the Impacts Targeting and Assessment Program, and our work to add value in intensive systems in Asia, freeing land for other high value crops, are examples.

CIMMYT and the Millennium Development Goals
To achieve the main United Nations Millennium Development Goals (MDG) to reduce by half the proportion of the world living in extreme poverty and hunger by 2015, more than 22 million people will have to escape poverty and hunger every year. Clearly many of these people will be in rural areas and depend on wheat or maize as their staple foods. CIMMYT's work is crucial in producing the more productive, nutritious varieties, and more resource and land efficient cropping practices to meet the needs of these people. But better varieties and cropping practices only have impact when they are adopted and other constraints to production and distribution are addressed. For that reason, in addition to using the maize and wheat genetic diversity held in our genebank, we are also advocating appropriate policies to foster food and economic security and are working hand in hand with partners along the impact pathways. CIMMYT's work contributes primarily to MDG1 *(Eradicate extreme poverty and hunger)* but also to the other MDG goals, both directly and indirectly.

CIMMYT has been, is and will continue to be a center of global excellence in maize and wheat science. That excellence has been honored many times. In 2004, for example, the RWC, an alliance of national programs with the support of CIMMYT, IRRI and other partners, was recognized by the awarding of the CGIAR King Baudouin Award. That work began long before the strategic plan was written. The vision in "Seeds of Innovation" is not revolutionary but evolutionary; a refinement of focus so that CIMMYT can help deliver not just improved germplasm, but outcomes from that

improved germplasm. That has always been CIMMYT's strength and it is on that strength that CIMMYT will continue to build.

Background to changes since 2004

CIMMYT has gone through substantial shifts in research program management over the last 12 months that now allows it to more effectively deliver on its mission. This has meant several key changes in staffing and some shifts in program focus and priorities.

During the last 12 months the center created and filled the position of Deputy Director General for Research. This position is crucial to the management of the research agenda with responsibility for overall management and balance of this agenda, staff recruitment and retention, regionalization of the programs and maintenance of the outstanding science quality that has long been a hallmark of CIMMYT's work.

The center over the last 12 months was able, in large part, to consolidate the new six program structure and went through an extensive process to hire new Program Directors. The 5th EPMR in its report comments on the extraordinary quality of the new staff, and we believe that this bodes well for CIMMYT to implement its agenda. As part of the continuing regionalization of its programs, so as to be closer to the stakeholders and to be more effective in partnership-based activities, CIMMYT will, for the first time in its history, have half of its Program Director positions based outside of its headquarters in Mexico. We believe this not only will greatly enhance interactions with NARS, but will also strengthen interaction with key CGIAR sister centers such as IRRI and ICARDA.

The center has also in the last 12 months been going through re-alignment of staffing to deal not only with changes required due to the financial situation of the center, but also to address shifts in program and regional balance as well as a demographic "bump" that lead to retirement of a number of more senior staff members. Once again the feedback from the EMPR has been very positive as to the outstanding quality of new staff being added to the research programs.

Most new Program Directors joined the center in late 2004, early 2005, and the main business at hand for the early part of 2005 has been a number of workshops and meetings to focus strongly on the refinement and implementation of the CIMMYT strategy. This includes very clear indications of priorities within programs and balance between programs. Given the current funding scenario (almost two-thirds of CIMMYT's current agenda is determined by restricted or project funding), with substantial restricted projects being implemented, the center is somewhat limited in its capacity to affect rapid programmatic change. Changes will be incremental as programs factor new and changing priorities into project proposals. That said, the programs and the center have been very focused on developing clear and sound priorities that clearly indicate what work shall be carried out directly by CIMMYT scientists, what work will be performed primarily by partners, and what work at the present time is of concern to the overall agenda of CIMMYT but that will not be carried out, either due to lack of resources, or because the center has no comparative advantage to perform the work.

Priority setting and focusing the agenda

As just stated, the research staff have conducted multiple, in-depth discussions in relation to program priorities and a clear agenda. A summary table (see Table 1) is included that addresses some of the key elements of how work will be divided between CIMMYT staff members and partners. CIMMYT cannot implement in-house all of the important issues outlined in the "Seeds of Innovation" strategic plan. That document sets a frame for the vision; the center business plan being developed, and this

MTP, set the operational steps that clarify the specific role of CIMMYT staff in achieving that vision.

As is the case in any exercise of this nature, it is clear that there are elements of work that will not be done, due to overstretched resources or lack of comparative advantage. The center is clear what those areas are and several of them are outlined in the summary table.

Where is the CIMMYT comparative advantage? How do we leverage that to meet our Vision?
In the vision document "Seeds of Innovation" CIMMYT indicates that it will shift its outputs focus to be more consistent with the CGIAR mission statement of addressing livelihoods and poverty. The vision document also refers to CIMMYT maintaining its enduring or continuing strengths. The enduring strength of CIMMYT has always been and will continue to be, in the areas of genetic resource conservation and use, plant breeding (including the use of new tools), and systems agronomy. There are however constraints and problems that are created by the need to invest in new or under resourced areas, such as biotechnology, knowledge management, social science and training / capacity building. These constraints are further exacerbated by the financial situation of CIMMYT and a funding environment that is not very conducive to investing in long-term plant breeding efforts.

The reality regarding plant breeding at CIMMYT
CIMMYT does have a critical mass in plant breeding for both maize and wheat. However, that critical mass is disturbingly thin. We cannot lose any additional senior staff and must garnish further donor support to strengthen this area with the addition of more senior breeders. It should be noted that the financing plan includes provision for the recruitment of four new plant breeders. We believe from the available data that CIMMYT still invests more in crop improvement than any other CGIAR center, but given that this is our core business that is not surprising, and it is still in actual dollar figures an inadequate amount. There is a need for CIMMYT to add experienced field-oriented plant breeders to complement our investment in biotechnology expertise.

CIMMYT continues to invest in the application of new tools in plant breeding, but realizes that it needs further capital investment and updating both in its field and laboratory operations supporting the crop improvement efforts. Some capital improvements are planned in 2005 and further enhancements will be made in 2006 and beyond, subject to funding support as clearly indicated in the 5th EPMR report.

Better targeting for CIMMYT research outputs
As indicated above, the major focus of CIMMYT will continue to be the deployment of improved maize and wheat germplasm, coupled to crop management (with an emphasis on conservation agriculture); however, there must be a conscious drive to better focus the benefits of these materials and technologies on the resource poor in order to more effectively deliver on the CIMMYT and CGIAR mission statements.

CIMMYT does not intend to undertake livestock research; to become a center for poverty research; to carry out broad based livelihood studies; or, to enter into the field of macroeconomics. We intend to build on the historic strengths of CIMMYT in the agricultural economics of maize and wheat systems, but in a way that allows our breeders to better identify crucial traits and to better deploy technologies, information and products. In this area the role of partnerships with sister centers of the CGIAR and beyond will be a crucial element of the strategy. CIMMYT has hired during 2005 a new poverty specialist and an impacts specialist that will spearhead the refining of our strategy and serve as focal points for interactions with key partners.

There is also a need for more effective information / database management, and knowledge management and use in relation to the targeting of center outputs. Increased investment in data management for the breeding work of the center will also be crucial as a way of maximizing efficiency and improved germplasm development. To that end the center is investing a significant proportion of its unrestricted funding into crop information systems and database management.

Program cross-linking: major research themes
The current management structure of CIMMYT is designed to put CIMMYT staff closer to the NARS for whom we work. However, there are problems that flow from having significant staff deployment in various parts of the world, which go beyond normal communication matters and are linked to the coordinated development of improved materials and technologies.

CIMMYT has disciplinary mechanisms in place that allow for cross program discussion of center-wide issues. While this has in the past been strictly focused on areas such as maize and wheat improvement, we see this evolving over the coming years to enable more specific interactions. These will include a focus on breeding for drought, and database management of crop breeding and enhancement and genomic data.

Programme Discussion: 2004 actual and 2005 estimate

Highlights from 2004
In 2004 the center continued to deliver high-quality science for development. On an output by output basis, all six programs achieved or exceeded research expectations for the year. The quality of CIMMYT's research was recognized and praised in the recent EPMR. We have selected one output from each program to illustrate both the range of leading edge research activities and the coherence among them, all fitting within the vision of "Seeds of Innovation."

Genetic Resources
The team made considerable progress in the development and application of molecular breeding techniques for integrating improved traits into both maize and wheat varieties. For example drought tolerance in maize was mapped through large-scale, replicated multi-location trials. That work was enhanced by the development of advanced methodologies and software support systems for molecular breeding of drought tolerant maize, based on consensus maps.

Software Support Systems
In 2004 CIMMYT formally amalgamated under single management (through the Genetic Resources Program) the maize and wheat genebanks. Now we are working to integrate the genebank and germplasm enhancement data management systems and by 2006 will have invested over $200,000 towards creating this integrated informatics system and initiating the huge associated data curation activity. The genebank information system will use a range of integrated modules to fully computerize data acquisition, genebank management, germplasm evaluation (including genomics data) and database queries across both crops. Several modules have already been completed and a unified database in support of this system is being created. Nearly three million data points have currently been computerized for this purpose.

In fact coping and making sense of such large amounts of data, both from the genebank and from genomics work at CIMMYT in general, is becoming more and more difficult. The CIMMYT bioinformatics team, working with partners at the National Center for Genome Resources (NCGR)

has just developed a new software tool called the Comparative Map and Trait Viewer that gives molecular breeders better ways to visualize their data. It can be used in conjunction with crop information systems such as the International Wheat Information System (IWIS), developed by CIMMYT and the International Crop Information System (ICIS), the new generation derivative from IWIS that is becoming a common global platform for crop informatics.

Based on this critical foundation, CIMMYT is also working towards creating a larger overall system whereby all types of data from the entire spectrum of genetic resources activities can be integrated, compared and collectively analyzed and/or queried by anyone anywhere. The Generation Challenge Program and IRRI Alliance offer CIMMYT substantial opportunities to join a framework, utilize recent advances and access expertise that will help to quickly create a system largely based on the best components of various pre-existing software systems, while at the same time allowing diverse users to continue working with their preferred database formats. This will facilitate the development of a unified system across wheat and maize while also providing opportunities for interfacing with other cereals, including rice. CIMMYT is investing around $165,000 during 2005 in projects contributing to this goal that have been prioritized by a committee of ICT-KM specialists and diverse users across the programs and disciplinary groups (including breeding, genomics and bioinformatics).

Impacts Targeting and Assessment

In policy strategy work the program completed the development of a framework to estimate the benefits and risks of introducing transgenic maize varieties into Mexico. The completed report has been disseminated. On another front, the group is concluding five thematic impact studies, including the Asian Maize Biotechnology Network (AMBIONET), Training, Participatory Research in CIMMYT and of the Southern Africa Drought and Low Soil Fertility Program (SADLF).

The elucidation of impact pathways is another of the ways in which ITA staff are working with CIMMYT scientists and the center's partners to draw valuable lessons, sharpen priorities, and identify opportunities for scaling up useful results.

A typical impact pathway

Following the chain of events from research, through adoption, to farmers reaping economic benefits and, ultimately, to improvements in the quality of life of ordinary rural people is a voyage of discovery. There are many steps and turnings in such "impact pathways," which yield many direct and indirect benefits. Scientists in CIMMYT's Impacts Targeting and Assessment Program are now mapping the pathways that link improvement of the humble wheat crop and wheat farming systems to increased farm incomes, rural economy growth and poverty reduction. They cite, among myriad others, the case of Anil Singh, a farmer from a remote, relatively poor area of Uttar Pradesh, India. Singh has benefited in unexpected ways from the efforts of scientists and development agents working with CIMMYT, national programs of India, and the Rice-Wheat Consortium for the Indo-Gangetic Plains (RWC), in which the Center participates.

Working closely with CIMMYT and RWC scientists, national breeders continuously develop and release new, high-yielding, stress-tolerant wheat varieties, and since the late 1990s have conducted participatory varietal selection with resource-poor farmers in the eastern Indo-Gangetic Plains. Farmers region-wide are also adopting a range of resource-conserving practices promoted by the Consortium, among them the direct sowing of wheat without plowing, a method being used on more than 2 million hectares in 2004.

Before adopting the no-till seeding of wheat or participating in the selection of new, high-yielding varieties, Singh and his family of 13 had formerly scraped by, growing only a rice-wheat rotation on some six hectares of land. With reduced tillage and direct seeding, he and other early adopters increased harvests and saved seed, labor, diesel, farm equipment, and irrigation water—all of which added up to additional cash income. Using the direct seeding implement, Singh hired out his services to other farmers, and made more money there. Then, the improved wheat he began using yielded much more than the varieties he used before, providing yet more income. As another parallel pathway to impacts, zero-tillage allowed earlier sowing of wheat, opening space in the cropping system for Singh to begin sowing high value cash crops such as okra, tomato, gourd, potato and mungbean. He also improved his use of non-organic fertilizers, has planted leguminous break crops, and observes that, as a result, the quality of his soil is improving.

Moving forward along these branching pathways, Singh began to think of yet more ways to benefit from his extra earnings. His next step was to invest in a new well and irrigation equipment, further improving the productivity of his cropping system and, ultimately, the value of his land. Around the same time, with support from local researchers, he launched a rice and wheat seed production and marketing company. After only a few years of operation, the company produces and sells 25 tons of quality seed each year and is engaging neighboring farmers in seed production.

Evidence of improvements in Singh's wealth at the end of these pathways is manifold: he has put an upper story on his home and purchased a used car, to mention just two. As more farmers in the community adopted the above practices, having seen the success of Singh and other early adopters, the prosperity has spread throughout the local economy. As recently as the late 1990s, Singh's village had no telephone or refrigerator, and now it has plenty of both. Perhaps more importantly, the "boom" has brought increased employment for landless laborers, thereby helping to reduce local poverty, and the demand for no-till seeding implements has also fueled the manufacturing industry in this region of northern India, extending the benefits further. .

African Livelihoods

The program provided seed of improved maize materials to national programs, private seed companies, and community-based seed production projects in Angola, Kenya, Malawi, Mozambique, South Africa, Tanzania, Uganda, Zambia and Zimbabwe. They in turn produced more than 20,000 tons of seed from the materials. This stimulated the emergence of a more diverse seed sector and represents the most rapid up-scaling of CIMMYT materials ever in Africa. In spite of resistance from the formal seed sector, there is now wide availability of open-pollinated varieties (OPVs) which resource-poor farmers prefer over hybrids.

Rainfed Wheat Systems

Traits related to improved water use efficiency and survival under drought were identified and transferred to elite, drought adapted, fixed what lines and segregating bulks. A total of 650 fixed lines and 190 segregating bulks, representing materials adapted to both high and low latitude stressed environments, were deployed across environments through CIMMYT's international nursery system.

Have Modern Wheats Lost Genetic Diversity?

Wheat varieties released by CIMMYT and its partners starting in the 1950s have been credited with averting mass starvation in the developing world, but critics have suggested that these wheats, planted on millions of hectares around the world, have led to genetic uniformity of the wheat gene pool as they replaced older, low-yielding farmer varieties, known as "landraces." Uniformity poses potential risks as a new disease, insect, or abiotic stress may cause yield loss on a very large scale.

To assess genetic diversity in CIMMYT wheat varieties over time, DNA markers were used to characterize landraces, old Green Revolution varieties, varieties released over the past 50 years, and

new breeding lines in yield trials. As expected, wheat genetic diversity fell off significantly in the 1960s, as improved varieties selected primarily for yield replaced landraces. Diversity appears to have held steady at that lower level through to the late 1980s, when it began to nose upward again. The upsurge continued throughout the 1990s, and the levels of genetic diversity in CIMMYT-derived varieties—sown on 75% of developing country wheat lands—are now as high as in the landraces, but yield and other traits are much improved. The study also shows that recent, improved varieties provide higher and more robust yields under all conditions, so farmers can sow less wheat to meet their food needs. Among other benefits, the resources saved improve household economies and allow farmers to diversify to other food and cash crops.

Several factors may explain the upswing in diversity. Breeders have drawn on more numerous and diverse breeding materials, including many landraces. This is partly fostered by the CIMMYT global wheat testing network. Participatory varietal selection and an increased focus on traits other than yield—stress tolerance, grain quality, and end-use characteristics, to name just a few—may also be adding diversity to breeders' offerings.

Finally, more and more new breeding lines contain contributions from a type of wheat known as a "synthetic." These are developed by re-enacting the original, natural cross between wild grasses and durum wheat that resulted in bread wheat. CIMMYT scientists have created hundreds, using dozens of wild grasses. The results provide a ready bridge to useful traits from the grasses, including such qualities as better tolerance to drought or saline soil conditions.

Tropical Ecosystems

Pilot projects were implemented in which farmers in poverty-dense areas were invited to participate in breeding improved versions of their preferred local varieties. Each farmer was asked which traits they would like to incorporate into their varieties; most responded "drought tolerance" and "storage pest resistance". The best first-year successes were in two regions where, despite drought, farmers achieved yields between 2.5 and 3.3 t/ha when using crosses from the project. A simple field guide was developed and is being distributed to farmers explaining the basic practice for improving maize varieties.

Intensive Agroecoystems

A second, greener "green revolution" is beginning in South Asia, the "breadbasket" and "rice bowl" for more than 1.3 billion people, where hundreds of millions of people derive their livelihoods from farming. Using small-scale, locally produced mechanization, the region's farmers are doing less plowing and moving toward "no-till" agriculture. Irrigation efficiency has increased dramatically, due to increased water penetration and decreased flooding of fields. Water savings range from 30 to 50 percent—amounting to a potential annual savings of 5 billion cubic meters of water. With less land preparation, wheat can be planted sooner after the monsoon rice crop, increasing productivity by at least 2.5 t/ha. Earlier harvest means farmers can plant profitable and nutritious legumes—after wheat and before rice. This improves soil fertility and makes these foods available and affordable for poor people. Crop diversification results in a more robust rural economy and the environmentally sound management of a vital agro-ecosystem.

Bringing Conservation Agriculture to the World's Most Disadvantaged Farmers

Building on successful experiences in South America and South Asia, as well as extensive work with partners in southern Africa on soil fertility, CIMMYT is helping small-scale farmers in sub-Saharan Africa to test and adopt practices that put more food on their tables, while saving money and natural resources.

With funding from BMZ, in 2004 the center began promoting conservation agriculture in smallholder maize-based systems in eastern and southern Africa. Focusing currently on two or three

communities each in Malawi, Tanzania, Zambia and Zimbabwe, activities include farmer participatory demonstration plots and evaluation of equipment, community awareness meetings, training for extension agents and researchers, and backstopping through on-farm and on-station research.

After less than a year of work and despite a severe drought in much of the region during 2004-05, there are already signs of impact. In the Bazale community in southern Malawi, seven smallholders formed a group for the crop season, each farm hosting a demonstration plot or on-farm research trial. Despite the drought, farmers were so impressed by the plots seeded without tillage and with a cover of maize residue that the group has now grown to 30, all wanting to try conservation agriculture on their fields next season. As farmer Kingsley Kamwendo told agronomists recently: "The residues helped to conserve moisture, because other crops seeded at the same time without residues died during the drought."

Farmers in Zambia and Zimbabwe were excited by an animal-drawn, zero-tillage seeder brought from Brazil. Farmer John Mwemba in the Malende community near Monze in Zambia has been managing conservation agriculture manually for several years, with help from the Conservation Farming Unit (CFU) of the Zambia National Farmers Union. This year he tried the Brazilian seeder and was astounded that he could sow and fertilize his half-hectare field in just two hours, instead of the two full days it would take him using conventional practices. Based on farmers' expressions of interest, both the Zambian CFU and a machinery manufacturer in Zimbabwe have contacted the manufacturer of the Brazilian seeder to arrange for local manufacture of something similar.

CIMMYT and partners will continue working to help African farmers find ways to retain at least some of their crop residues, thereby restoring soil organic matter and improving water-use efficiency.

Expectations for 2005

As we have said earlier in this document, we are continuing to implement the vision of "Seeds of Innovation", building on the core strengths of the center to deliver outputs most needed by our target client base.

We will also continue to build on the strength of our experiences with conservation agriculture in Asia by continuing to enhance our conservation agriculture work in maize systems in Africa.

CIMMYT's 5th EPMR

An external program and management review team has just completed a detailed study of CIMMYT and the work we do. It was the first EPMR at CIMMYT in eight years and was clearly overdue. The review panel identified many areas in which they felt CIMMYT could improve. Many of these areas had already been recognized by CIMMYT and plans to resolve the issues were already in place. Importantly for CIMMYT, the review panel recognized the continuing value of the high-quality science for development that CIMMYT conducts. CIMMYT intends to implement recommendations and suggestions contained in the report. Our detailed response to the EPMR and how we are addressing each point raised follows later in this document (see Table 3).

Highlights of the 2006 Project Portfolio

Looking to 2006, we continue to see breeding for specific traits important to the most marginalized poor farmers and their families as vital in the coming years. Our world-leading work in drought tolerance in both wheat and maize will continue both via traditional channels and in the case of wheat by the continued exploration of the potential of genetic enhancement with genes from other drought tolerant species. CIMMYT will also leverage its global leadership position to embark on mega initiatives such as one to preempt a potential stem rust pandemic in wheat.

Preventing an emerging crisis from developing into a global catastrophe

A recurring theme in CIMMYT's work is 'global research for local impacts'. Impacts are nearly always local first and only after massive scaling out or up do they become measurable in a macro sense.

That is equally true when a new pest or plant disease emerges. Here the first impact is always local. Unfortunately, the difficulty is to keep what is local, localized.

In 1999 researchers in the very local wheat-growing area of Uganda observed the first breakdown in more than 40 years of stem rust resistance in wheat. A new race of the fungus that devastated wheat in North America in the 1950s had emerged. According to Dr Norman Borlaug, the 1950s stem rust threat was a primary reason for establishing CIMMYT's predecessor, the Rockefeller Foundation-sponsored program in Mexico. The semi-dwarf, stem rust resistant, widely adapted spring wheat germplasm generated by this program led to the Green Revolution. The development of rust resistant varieties had a global impact but it was based on a single genetic source. While it was clear the resistance would not last forever, many national programs became complacent, believing stem rust was a long past threat.

Today, the Ug99 race has been observed in Kenya and Ethiopia as well as Uganda and wheat varieties grown in these countries are now susceptible. Recent experiments in Kenya showed that the new stem rust race could reduce wheat yield by up to 71%. If left unchecked, a 10% global wheat yield loss would cost the world's economy more than US$9 billion. At the local level, small-scale wheat farmers in Kenya would be devastated.

A new expert panel report funded by the Rockefeller Foundation has warned that the potential for the global spread of the fungus on both the wind and by humans is huge, with spread into the 12-million-hectare wheat-growing areas of the Indo-Gangetic Plains almost a certainty.

CIMMYT is assembling a team with partners from ICARDA, national programs, and advanced research institutes to find a way to prevent a rust pandemic and the subsequent, disastrous loss of food for developing country inhabitants. The Global Rust Initiative is a comprehensive program that will identify diverse sources of resistance and incorporate that resistance into wheat varieties for North Africa and Asia before the new pathogen race migrates to those areas. In addition, the initiative will establish a monitoring system in eastern Africa to catch new mutations and set up community-based seed production systems so that resource-poor farmers can obtain new, resistant varieties.

Collaboration

As indicated earlier, for much of the work outlined in the CIMMYT vision, partnerships will be an essential element of moving forward. Among others, these partnerships will involve sister centers ICARDA and IRRI.

The IRRI-CIMMYT Alliance
There are on-going discussions between IRRI and CIMMYT, facilitated by the Rockefeller Foundation, to explore various models of a stronger alliance between the two centers. Following the publication of the report of the RF-chaired oversight committee for the IRRI-CIMMYT Alliance in late November 2004, the Boards of Trustees convened a joint session in Shanghai at the beginning of January 2005.

At that meeting the Boards agreed to pursue the development of four alliance programs on intensive production systems in Asia, scientific informatics, climate change, and training and cereal knowledge banks. Each of these programs is intended to have a unified budget and management structure involving scientists of the two centers. The two centers will also develop mechanisms for shared services in a number of areas such as representative offices in certain developing countries. There have been exchanges of information between IRRI and CIMMYT staff, and a joint research leaders meeting was held at IRRI at the end of April 2005, with a follow-up meeting held at CIMMYT in early June.

Detailed project proposals and implementation plans for these alliance programs are being finalized at the time of submission of this MTP, and as they are firmed up, we will report back to the Science Council on progress made. CIMMYT fully endorses, and continues to do so, the recommendations of the IRRI-CIMMYT alliance Oversight Committee and Working Group, including those related to governance; with this strategic goal in mind, CIMMYT will continue to discuss and negotiate with IRRI.

CIMMYT and ICARDA
The relationship between CIMMYT and ICARDA has been a complex and frankly problematic one for many years. There is, however, reason for optimism in terms of how this relationship is moving forward. It is probably worth indicating the level of interaction that has been ongoing over the last few years and the significant upturn in progress being made on the ground over the last 12 months since the previous MTP.

A Timetable of Interactions:
July 2002: Meeting of Directors General, Board Chairs, and Program Directors, Davis.
September 2002: Meeting of Directors General, Board Chairs, and key center staff, Cairo.
February 2003: Directors General meet with Turkish officials to discuss the Turkey/CIMMYT/ICARDA International winter wheat improvement program, Ankara.
May 2003: Meeting of Directors General and Board Chairs, The Hague.
July 2003: Meeting of Directors General, Tokyo
May 2004: Meeting of Directors General, Tel Hadya, Syria
August 2004: Meeting of Deputy Directors General and Program Directors, Ankara
November 2004: Meeting of Directors and Deputy Directors General and Board Chairs, Mexico
November 2004: Joint center publication on wheat in CWANA (first time ever)
January 2005: Joint planning meeting of center scientists, Amman
April 2005: Joint meeting of Deputy Directors General and Program Directors to discuss cooperative program
May 2005: CIMMYT shares MTP with ICARDA for review and inputs
June 2005: New MOU to be agreed between the centers

Building of close cooperative links
There is no doubt that both centers can reap substantial gains from effective cooperation, exemplified by the Turkey / CIMMYT / ICARDA International Winter Wheat Improvement Program. The joint planning meeting in Amman (to which the chair of the CIMMYT EPMR was invited to attend) allowed scientists from both centers to develop a detailed matrix indicating areas of work and

comparative advantage. The result of this matrix, as expected by the Program Directors, clearly showed there were extraordinary complementarities with a minimum of overlap. The scientists developed a detailed plan of work for 2005-2006. This plan of work was then reviewed internally by each center and in April 2005 an approval was given by the management of each center to begin implementation of the agreed plan. At the time of writing this MTP the two centers have just conducted a joint planning meeting with NARS and have also performed a joint review of the wheat efforts of a NARS (Algeria).

The two centers have shared advance copies of their MTP's with each other for input and comment and the centers are in the process of developing a new MOU. The MOU clearly shall indicate to ICARDA the focus of CIMMYT on wheat improvement and wheat system agronomy. While the CIMMYT "Seeds of Innovation" talks of the importance of livestock and legumes in addressing poverty and livelihoods, we have clarified with ICARDA that this shall be achieved through partnership with them, and with NARS. Finally, the Board of Trustees of CIMMYT will hold its next meeting at ICARDA in November 2005. CIMMYT is committed to resolving its relationship with ICARDA.

Other partnerships

The commodities and strategy of CIMMYT also make special relationships with major NARS a key element of partnership arrangements moving forward. CIMMYT will host in June a mini-summit with Mexican institutions in order to find mechanisms to more fully engage in deep cooperative research using the significant levels of expertise available within the Mexican system. CIMMYT recently engaged EMBRAPA in Brazil with in-depth discussions as to how to work cooperatively not only for Brazil, but in a broader context of international research cooperation. Similar in depth discussions are ongoing in India and China and the importance of the commodities that CIMMYT works with adds urgency to developing effective cooperative research plans, funded in a tripartite manner. These are examples of how CIMMYT is engaging the larger NARS partners and seeking more mechanisms for south-south interactions. It must be recognized, however, that CIMMYT has multiple high quality partnerships with many NARS, and these relationships are a key to farmer impacts. CIMMYT is also engaged with private sector companies to set up an International Plant Breeding Symposium to be held in Mexico every two or three years with a focus on field-oriented plant breeding. CIMMYT's approach to partnerships elaborated in "Seeds of Innovation", however, is perhaps best typified by the current Insect Resistant Maize for Africa (IRMA) project involving the Kenya Agricultural Research Institute (KARI), CIMMYT and the Syngenta Foundation for Sustainable Agriculture.

CIMMYT involvement in the Challenge Programs

CIMMYT views its participation in the Challenge Programs as an integral part of our strategy for partnership development with both developing and developed country partners and sister centres. CIMMYT's engagement with the Challenge Programs includes:

- Generation- CIMMYT hosts this program and also provides one of the sub-program leaders
- HarvestPlus- CIMMYT provides two crop coordinators; maize and wheat, and participates in socioeconomic projects
- Water and Food- current involvement in two projects for the Yellow River and Limpopo Basins
- Sub Saharan Africa- participation in planning meetings and other activities.

Internal Organization of Research

The MTP, for reasons of timing and structure, is reported along program lines. We re-emphasize the tremendous work that has gone into these by all CIMMYT scientific staff under the direction of the new Program Directors. These log frames, coupled to the earlier summary table of priorities, gives a

clear view of how CIMMYT will build on its existing strengths, together with the energy and skills of its new staff, to contribute to the mission and goals of the CGIAR and CIMMYT.

Center Financial Indicators

The primary financial and managerial focus of CIMMYT management during the period of this MTP can be summarized as follows:

a. Maintain a strong commitment to rebuilding the Institute's reserves;
b. Finalize the staff adjustments that were initiated to enable the implementation of the strategic plan and to seek opportunities to fund 'deepening the pool' of plant breeders;
c. Target investments in assets that will drive significant operational efficiencies;
d. Maintain a concerted fundraising program; and,
e. Implementation of full cost recovery on all CIMMYT projects

CIMMYT Funding Overview

Our grant revenue estimates for unrestricted and restricted grants, as detailed in this MTP submission, indicate total revenues of approximately $39.08M for 2005 and $36.86M for 2006. Unrestricted grants from donors are predicted to decline in both 2005 and 2006 due to a combination of real reductions in investments from certain donors compounded by a retreat of the US Dollar from the levels of previous years. In addition, certain targeted funding from CIDA and Japan is now clearly identified as restricted from 2005 onward. Overall unrestricted funding will not decline to any material degree during this period as the reduction in donor funding will be partially offset by increased Center interest income resulting from an improvement in our reserves and our overall liquidity. Unrestricted funding will amount to 38.6% of total funding for 2005 and will increase, in percentage terms, to 40.8% in 2006 due to the projected decrease in restricted funding for the year.

Projected revenues for 2005 are slightly less than the 2004 actual result and we project a further reduction for 2006 due to the fact that the short-term impact of expenditures incurred in the implementation of our strategic plan will reduce significantly in 2006 and future years. As the restructuring activities are wound down, both revenues and expenditures will decline. We believe that total revenue projections of $36.8M for 2006 are a conservative but realistic estimate of our sustainable, long-term funding base.

Given that the preparation of the MTP has been drawn forward again this year, there remains a higher level of uncertainty in our income predictions than in past MTPs. We have therefore clearly shown "unidentified" restricted project funding for 2006 amounting to $4M. We remain confident that this funding will be achieved through active fundraising efforts that are currently being implemented by the restructured management team. An important part of this unidentified funding - $1M - relates to management's plan to recruit two senior wheat breeders and two senior maize breeders. A major effort will be undertaken by management to obtain funding for these positions as a reflection of the high priority that is attached to this development.

Working Capital Reserves

During 2004 year, CIMMYT was able to increase undesignated, unrestricted reserves from approximately $3M (30 days) to a level in excess of $4.8M (47.5 days). This increase represents a substantial move towards the Board and management's stated goal of building reserves to the CGIAR mandated standard of 75-90 days by December 2007.

Despite the substantial gains that have been made during the last two years, there remains much to do to rebuild reserves to the required level. At this point, CIMMYT has budgeted to put aside $2M per year over the 2005-06 period to reach the target. It must be noted however, that the need to

improve our reserve position continues to place severe pressure on our annual operating budgets. As a not-for-profit organization, increases in reserves can only be achieved through the under-spending of unrestricted funding income. Therefore, given that true operating flexibility is enabled through maximizing the availability of unrestricted funding, any reduction in the availability of unrestricted funding is a severe constraint to CIMMYT's ongoing operations.

As a result of the increase in reserves, CIMMYT achieved its stated goal of moving from debt funding to a cash positive position during 2004. It is anticipated that we will continue to operate in a cash positive position for the plan period.

Staffing

As reported in the previous year, CIMMYT planned a series of major staff changes to move rapidly to ensure that it had the core competencies required to implement its new strategy. During 2004 a total of 20 new IRS were recruited which, following the departure of 25 staff in the same period, resulted in total IRS staff numbers falling to 95.

The staff changes have continued at a lesser pace during 2005; however, by the end of this year, a further 14 new staff will have been appointed and there will be additional departures of 19 staff. Based on these changes, IRS staffing numbers will fall to a level of 90. The change in IRS reflects the needs of the new research program; the new skills and culture of the centre; and, CIMMYT' overall human resource goals.

CIMMYT will undertake a further round of recruitments during 2006, if it is successful in its fundraising strategy. Depending on the availability of funding, an additional seven staff will be recruited which will bring total IRS numbers to 97, viewed as a sustainable long-term level. Of particular importance is the plan to substantially boost capacity in plant breeding through the recruitment of four senior plant breeders.

In response to the stated aim of decentralizing management staff throughout the regions rather than in one head office, CIMMYT has successfully established two Program Director positions outside of Mexico with one further position to be relocated during 2006. In addition, several key research positions have been either relocated or specifically recruited as regional positions.

Following the completion of a detailed training needs analysis during 2004, CIMMYT has developed a training plan for all NRS staff. To ensure that training is effectively and consistently delivered, CIMMYT has committed significant financial resources to staff training, starting with 2004 and continuing through 2005 and 2006.

Infrastructure

Following on from its prior year commitment to increase investment in fixed assets during 2004, CIMMYT has continued to plan to reinvest amounts equal to depreciation in its fixed assets. Particular emphasis has been directed at identifying investments that will rapidly lead to enhanced efficiency and cost savings within our operations. We expect that the results of these investments will drive future savings that can then be reinvested in further capital improvements. The primary area of focus has been investments that will improve the efficiency of our plant breeding operations at the various experimental stations throughout the world. We have recognized the need to adopt world best practice and are committed to effect the necessary changes.

Table 1: Institutional priorities 2006-2008

	What will CIMMYT do[1]	What will CIMMYT do through partnerships[2]	What CIMMYT will not do[3]
Institution	• Conservation of genetic resources • Identification of useful genetic diversity • Maize and wheat germplasm enhancement • Resource conservation technology options for maize and wheat cropping systems • Capacity building and institutional strengthening	• Development of crop information system platforms • Cropping system studies involving crops in addition to maize and wheat • Study of livelihood strategies based on livestock/feed interactions • Livelihood and poverty studies beyond maize and wheat systems • Development and implementation of knowledge management strategies	• Work on livestock • Work on legumes (except in conservation agriculture rotations) • Macroeconomic studies • Genetic transformation work (except work on Bt maize and drought genes)
Program 1 *Genetic Resources*	• Collection and conservation of crop-related bio-diversity • Trait and gene-based identification of useful genetic diversity • Development of germplasm characterisation and enhancement information systems • Methodologies for improved efficiency of germplasm utilization and enhancement • Development of global trait-based public bioscience platforms (e.g., drought, rust, Fusarium)	• *In situ* conservation and management of bio-diversity • Generic pre-breeding activities • Up-stream, basic research • Trait mapping	• On-farm management of maize and wheat genetic diversity • General characterization of genebank entries • Analysis of policies related to genetic resources and diversity • Economic assessment of the value of genetic resources
Program 2 *Impacts, Targeting, and Assessment*	• Improved priority-setting and targeting of research in wheat-based and maize-based farming systems • Working guidelines for systems, livelihoods and economic growth and poverty-oriented impact assessment • Ex ante/ ex post impact assessments of CIMMYT research • Assessment of the role of quality in maize and wheat value-added chains • Demand driven capacity-building and training	• Support to macro-economic studies in countries with national policy constraints to maize and wheat production • Design of national policy interventions • Implementation of policies • Global mentoring service to back up learning and capacity building activities • Global impact of CIMMYT's work	• Advocacy of economic policies related to maize- and wheat-based farming systems. • Publications in less relevant journals • Individual training programs
Program 3 *African Livelihoods*	• Develop stress tolerant maize and wheat germplasm targeted at resource-poor farmers' needs • Develop maize with improved productivity and improved quality	• Deployment of stress tolerant maize and wheat germplasm • Promote approaches that increase farm level productivity and access to markets	• Macro-economic studies on maize- and wheat-based systems • Breeding maize with high levels of Iron and Zinc

[1] Work is primarily conducted by CIMMYT employees, but will clearly involve NARS.
[2] Work carried out in partnerships with CIMMYT, with the majority of the work being performed by partner organizations.
[3] Work where CIMMYT does not feel it has any comparative advantage to be involved with the work during the indicated time frame.

	What will CIMMYT do[1]	What will CIMMYT do through partnerships[2]	What CIMMYT will not do[3]
	improved quality • Facilitating smallholder farmer experimentation with resource-conserving technologies • Strengthen production and marketing of maize seed for marginal environments • Assists NARS to address regional maize and wheat research priorities	productivity and access to markets • Research into input/ output policies for maize and wheat markets • Development of regional seed laws and regulations • Training of farmer/ farmer support groups	and Zinc • Production of seed other than maize breeder seed • Further development of best bet soil fertility technologies
Program 4 *Rainfed Wheat Systems*	• Spring and winter wheat (bread, durum) advanced lines with enhanced end-use quality and tolerance to stress • Wheat germplasm with enhanced resistance to rust and root pathogens • Global monitoring and pre-emptive screening for new diseases of wheat and rust virulence • Facilitating the adoption of resource-conserving technologies • Use of landraces and genetic stocks for improving drought and heat tolerance	• Winter wheat improvement (Turkey/CIMMYT/ICARDA) • Screening of wheat germplasm for micronutrient tolerance and grain levels • Development and promotion of conservation agriculture technologies including machinery • Research on soil borne diseases • Socioeconomic studies on poverty, livelihoods and gender	• Winter wheat breeding in Mexico • Work on crop-livestock systems (except residue management and fodder in reduced tillage systems) • Work on legumes (except in conservation agriculture rotations) • Farm-level surveys aimed at collecting primary data • Rapid methods for assessing soil salinity/fertility
Program 5 *Tropical Ecosystems*	• Increased maize productivity in drought-prone areas of South East Asia • Improved maize productivity and quality (quality protein maize) in Latin America • Technology options for impoverished maize farmers in highland areas (especially Mexico) • Germplasm and "proof of concept" for methodologies to enhance pro-vitamin A concentration • Germplasm and methodologies to develop maize for acid soils	• Participatory evaluation of stress-tolerant germplasm by farmers in several countries of Asia, Latin America • Research and technology dissemination to mitigate on-farm post-harvest losses • Enhanced capacity to evaluate and breed for stress tolerance of maize germplasm	• Research projects to measure the socioeconomic and ecological sustainability consequences of new technology adoption • Research and promotion of crop management options, including conservation tillage • Population improvement for tropical white, non-QPM maize germplasm. • Population improvement and routine breeding work in maize physiology
Program 6 *Intensive Agroecosystems*	• Maize and wheat crops produced more efficiently at lower cost • Diversified cereal-livestock cropping systems • Resource conserving technologies • Enhanced regional plant breeding, including participatory varietal selection and seed delivery systems • Social science research for technology targeting and priority setting; diversification; and food security	• Role of crops in diversified systems • Food and feed commodity chain research in both maize and wheat • Fodder/stover quality of wheat and maize germplasm • Farm machinery research and development in Asia	• "Generic" plant breeding • Extension, especially as it relates to seed delivery systems • Sub-tropical maize breeding in Mexico • Development projects that lack a research component

Table 2: CGIAR Science Council Priority Setting (CSC), CIMMYT Institutional Priority Targets (IPT) and Program Outputs

	IPT 1: Saving and studying maize and wheat genetic diversity for humanity	IPT 2: Developing and delivering better maize and wheat germplasm faster	IPT 3: Delivering better cropping practices for maize and wheat systems	IPT4: Enhancing the capacity of our partners and networks
CSC 1: Sustaining biodiversity for current and future generations	GRP 1: Global custodianship, characterization and management of the genetic resources of maize, wheat and related species ITA 2: Analysis of local sustainable management of genetic diversity			
CSC 2: Producing food at lower cost through genetic improvement		GRP 2: Improved methodologies for the identification and utilization of useful maize and wheat germplasm ITA 1: Strategic priority setting for maize and wheat system improvement and the identification of enabling policies ALP 1: Stress tolerant, more nutritious maize and wheat varieties that increase food for resource-poor farmers in Sub Saharan Africa RWS 1: Wheat germplasm development and exchange RWS 2: Tapping new genetic diversity for rainfed wheat production RWS 4: Molecular and information technology tools for more efficient wheat breeding TES 1: Stress tolerant maize for tropical environments TES 2: Maize with enhanced grain quality IAP 2: Production technologies and supporting policies for stressed environments		ALP 4: More diverse maize seed sector in ESA responding to resource-poor farmers' needs

CSC 3: Creating wealth among the rural poor through high-value commodities and products		ITA 3: Analysis of role of grain quality (micro-nutrients, protein) in the improvement of livelihoods of rural poor in selected maize and maize systems ALP 2: Maize- and wheat-based systems that increase marketing options for smallholder farmers	IAP 1: New maize and wheat production technologies that facilitate diversification	
CSC 4: Combining poverty alleviation and sustainable management of water, land and forestry resources			ALP 2: Risk-averting, productivity-enhancing management practices that restore natural resources in maize- and wheat-based systems RFWS 3: Resource-conserving rainfed wheat systems IAP 3: Resource-conserving technologies for maize and wheat systems	
CSC 5: Improving policies and facilitating institutional innovation to support sustainable reduction of poverty and hunger		RFWS 5: Understanding constraints to technology adoption		GRP 3: Enhanced capacity in genetic resources management, maintenance and use ITA 4: Partners strengthened in research and development of maize- and wheat-based systems ALP 5: Capacity building of partners in the maize and wheat research-marketing continuum RWS 6: Training and capacity building TES 3: Networking and partnership building IAP 4: Training and human resources in research-for-development strengthened

GRP = Genetic Resources Program
ITA = Impacts Targeting and Assessment Program
ALP = African Livelihoods Program
RWS = Rainfed Wheat Systems Program
TES = Tropical Ecosystems Program
IAP = Intensive Agroecosystems Program

Table 3: Implementation of 5th EPMR recommendations

Recommendation	CIMMYT implementation plan
1. *The Panel recommends that management and programme directors undertake a much more rigorous process to define goals for the new strategy that provide a framework within which to organize projects and activities and against which progress in meeting the goals can be measured. In addition to strengthening the implementation of the new strategy, the process will enable the programme directors as a team to identify a set of goals that are congruent across the Centre.*	CIMMYT agrees with the recommendation and has developed institutional goals for the new strategy (outlined in summary form in the MTP Overview) along with very clear indications of priorities within programs and balance between programs (refer to the institutional priorities table).
2. *The Panel recommends that CIMMYT develop a business strategic plan that will support the successful implementation of the new strategy in the face of a dynamic financial environment.*	CIMMYT agrees with the recommendation and will develop a business plan that operationalizes the "Seeds of Innovation" vision with clearly stated program goals, milestones, deliverables, focus and balance. The document will also show clear linkages between the setting of institution and program goals, resource mobilization and program budgets. This exercise is also very closely linked to the development of the current MTP (2006-2008) and attendant financing and resource mobilization plans. The business plan will be tabled for CIMMYT BOT approval at its next meeting, November '05
3. *The Panel recommends that CIMMYT management and board undertake a mid-term review in 2007 focused on the implementation of the new strategy, the efficacy of CIMMYT's reorganization and the impact of financial capacity on CIMMYT's programmes and operations.*	CIMMYT agrees with the recommendation and will work with the CGIAR on the review to be held May/June '06.
4. *To facilitate the establishment of a multidisciplinary approach to conducting ex ante impact studies, the Panel recommends that increased integration through time allocation be secured between ITA staff and non-social scientists in the other programmes.*	CIMMYT agrees with the recommendation and will review staff time allocations during 2005. Furthermore, an impacts framework workshop was held in May '05 with the participation of scientists from all programs. A second workshop on targeting, to be held July/August '05, will focus on plans for multi-disciplinary ex-ante impact assessment.
5. *The Panel recommends that ITA, in cooperation with the ecoregional programmes, collect data on the variables that explain the heterogeneity of the existing production functions and thus, of yields (both potential and actual) that express differences attributable to productivity gaps within the same agroecological region, due to constraints that limit the adoption of improved technology.*	CIMMYT agrees with the recommendation and during 2005 will start the syntheses to construct the spatial meta knowledge of impact pathways, in partnership between the ITA Program and the regional programs. Activities will commence in two macro-systems: maize mixed farming systems in Sub-Saharan Africa; and, rice-wheat farming systems across Pakistan and Bangladesh.
6. *The Panel recommends that ITA initiate macroeconomic studies by 2006 in close cooperation with IFPRI and other CGIAR Centres. The highest priority should be assigned to sub-Saharan African countries.*	CIMMYT agrees with the recommendation insofar as it refers to analyzing sectoral and rural development policy determinants of wheat- and maize-based farming systems improvement and to identify and advocate appropriate policy and institutional responses. Discussions have commenced with IFPRI on cooperation, with key meetings scheduled for May and June '05.
7. *The Panel recommends that maize research in CIMMYT identify the high priority Marginal Maize Production Areas (MMPAs) in each mega-environment. Based on such MMPAs, a seed delivery system for improved cultivars should be developed jointly with partners as a vehicle to make CIMMYT's upstream maize research results available to resource-poor farmers.*	CIMMYT accepts the recommendation and has addressed the issue within the new MTP, consistent with CGIAR system priorities 2 and 5. The African Livelihoods Program outputs 1 and 4 directly address the recommendation with a new staff member recruited to work with NARS partners on the improvement of seed delivery systems for outlying areas.
8. *The Panel recommends that maize breeding and research efforts in the following areas be intensified:* a. *Grain quality characteristics of high priority to end users in MMPAs, combined with more systematic research and breeding to reduce mycotoxin contamination on the grain;*	CIMMYT agrees with this recommendation but, notes the need for additional, sustainable resources to ensure that new initiatives have a medium- to longer-term outlook. In the meantime, CIMMYT will explore

Recommendation	CIMMYT implementation plan
	opportunities for collaborative work in this area with IITA. In addition, CIMMYT will work with partners in various countries to test and promote simple, inexpensive grain storage structures that can reduce the deterioration of grain quality during on-farm storage.
b. Testing and evaluation of breeding materials directly in the MMPAs, for identification of the best material for release;	CIMMYT notes this recommendation and observes it is routine procedure for experimental materials to be tested in their target environments. CIMMYT has made very significant progress in MMPAs using farmer participatory "Mother-Baby" trials (>1M ha in southern Africa sown with improved maize using this approach) and acknowledges the recommendation as being a strong endorsement of this approach.
c. Non-transgenic host plant insect resistance research to speed up the process of integration of the highly resistant CIMMYT germplasm into new varieties;	CIMMYT notes this recommendation. CIMMYT has invested in host plant resistance work for at least 30 years and considerable progress has been made; however, transgenic approaches to insect resistance are increasingly providing significant technical gains. We will continue to work on an integrated pest management strategy that is reflected in a number of ongoing projects. The current emphasis is to improve the agronomic performance of our best insect resistant sources, thereby accelerating their use in breeding programs.
d. Application of fast track breeding techniques (doubled haploid, MAS, NIR techniques) in all maize breeding activities in CIMMYT;	CIMMYT partially agrees with this recommendation, as the value of these technologies should be assessed on a case-by-case basis. The use of double haploids in maize is a relatively new technique and its utility for marginal and low-input environments is yet to be proven. MAS becomes feasible only when several traits may be selected at once and both double haploids and NIR require considerable start-up work prior to their routine use. Efforts will be made to develop capacity in partnership with ARI collaborators.
e. Acquisition, storage and management of maize breeding data to eliminate the current back-log.	CIMMYT agrees with this recommendation and notes that decisions have already been made to allocate more resources to the acquisition, storage, and management of maize breeding data. During 2005, $165,000 of additional funding has been allocated to bioinformatics.
9. The Panel recommends that: *a. Crop management research in (the) TES (Program) in the regions be strengthened by allocating NRM (Crop and Resource Management) staff time from other programmes, particularly IAP, to TES;*	CIMMYT agrees with the recommendation and notes that there are at least two avenues to be pursued: a) additional financial resources for the TES Program; and b) increasing the overall staffing and cross program assignments of crop and resource management scientists generally. The recommendation will be implemented as and when extra resources become available.
b. CIMMYT, TES in particular, seek collaboration with other CGIAR Centres in the region, including shared appointments of agronomists and other natural resources specialists;	CIMMYT agrees in principle with the recommendation. We will follow up on some initial discussions that have already been held with three other centers and also on emerging collaboration among centers within the Water and Food Challenge Program. Additional resources are needed to fully address this recommendation.
c. The Crop and Resource Management Group, TES and other ecoregional programmes enhance strategic research on natural resource management, particularly for improved water and nutrient use efficiency.	CIMMYT agrees with the recommendation. It is hoped to emphasize strategic research in future projects with appropriate funding.
10. The Panel recommends that the IAP breeding teams work closely with crop management and social science groups to develop cultivars that are suitable for conservation agriculture, use water efficiently and are resistant to storage losses.	CIMMYT notes the recommendation and observes that the plant breeding programs in both maize and wheat, in recent years, have aimed at the development of germplasm with an emphasis on input use efficiency (water) and resistance to storage losses (maize) and the development of materials suited to conservation agriculture. The

Recommendation	CIMMYT implementation plan
	breeding programs in Mexico run parallel selection programs under conservation agriculture and conventional conditions.
11. The Panel recommends that IAP undertake long term experiments to evaluate cropping system sustainability with the results being fully utilized for strategic research as well as for demonstration purposes.	CIMMYT agrees with the recommendation insofar as it relates to long-term trials conducted on CIMMYT's experiment stations in Mexico and notes that trials over the past 10 years in Mexico have provided an excellent platform for strategic research and demonstration. In regional locations, CIMMYT collaborates with research partners to effectively design, manage and utilize long-term trials.
12. The Panel recommends that IAP increase its research in maize cropping systems and their development.	CIMMYT agrees with the recommendation and we will focus attention on the maize producing regions of Asia where demand is increasing at the fastest rate.
13. The Panel recommends that the data acquisition, data management and genebank user interface be upgraded in the CIMMYT genebank for both wheat and maize as a matter of urgency.	CIMMYT agrees with the recommendation and notes that significant steps are already underway through several different system-wide initiatives to develop a range of integrated modules for fully computerized data acquisition, genebank management, germplasm evaluation and database query across both crops. Additional funding has been allocated to the genebank in '05.
14. The Panel recommends that: *a. Training coordinator position be relocated to an independent Unit reporting directly to the DDG-R;* *b. The Training Unit working together with programme directors develop a priority setting tool, both thematic and geographical. The resulting priorities should then be used to allocate resource to the programmes;* *c. CIMMYT develop innovative alternative funding schemes for training*	CIMMYT notes the recommendation but will retain the training coordinator position in ITA for a number of strategic reasons. Performance and effectiveness of the position will be reviewed in December 2006. CIMMYT agrees in principle with the recommendation for training purposes. During 2005 a capacity building strategy will be formulated in consultation with all program directors. During July/August '05 at a targeting workshop, mechanisms for priority setting and targeting for training will be developed. CIMMYT agrees in principle with the recommendation and during 2005 has initiated discussions with public and private sector organizations to explore possibilities for new funding of training.
15. To help ensure that CIMMYT builds and sustains high functioning Boards, the Panel recommends the establishment of a governance committee with responsibility for a range of activities essential to Board effectiveness, including defining more clearly the role of the board, developing a more strategic process for identifying and recruiting board members, assessing board performance on a formal basis, evaluating the performance of members before re-election, recommending improvements to board practice, such as meeting design and preparation, information flow and communication, and developing an orientation and ongoing education program for members to enhance their performance	The CIMMYT Board had a one-day workshop on governance at its March 2005 meeting and agreed to reduce its size to no more than seven appointed members while maintaining the appropriate mix of skills, and to enhance the roles of the Audit and Finance and Administration Committees as agents of the Board. Rather than create a separate governance committee, CIMMYT intends to engage a specialist consultant to help the Board and its committees clarify their roles and put in place a more strategic process for identifying and recruiting board members, assessing board performance on a formal basis, and evaluating the performance of members before re-election. The consultant will also provide advice on meeting design and preparation, information flow and communication, and will work with the Board to develop an orientation and ongoing education program for trustees. It is anticipated that the consultant will also be engaged to review the effectiveness of the Board's processes, in the first instance on an annual basis. In future it is intended that the Board as a whole will explicitly address governance functions in lieu of a governance committee.
16. The Panel recommends that a dedicated staff person in the DG's office be identified to serve as the Board Secretary. This position should have sufficient status within the organization, clear responsibility and also adequate time to provide support and coordination for the board.	CIMMYT agrees with the recommendation and has already (effective March 2005) implemented this recommendation.

Recommendation	CIMMYT implementation plan
17. The Panel recommends that management review the staff survey results in detail with special attention to staff morale, communication of policies, clarity of goals, performance recognition, and staff evaluation, and take appropriate corrective action as a matter of urgency.	CIMMYT agrees with the recommendation and will implement a range of measures over the next 12 months aimed at: communicating policies, including the OneStaff concept; simplifying our management system and refining program and institutional goals; and, demonstrating a clear link between performance evaluation, promotion and professional development.
18. The Panel recommends that management give priority to reforming financial management at the Centre, including budget, staffing and related systems, with highest priority given to the development of a computerized financial management system that provides real on-time financial information to users; and urgently develop (in consultation with programme staff) a transparent resource allocation process consistent with needs of the matrix management system.	CIMMYT agrees with the recommendation and has taken the following steps: • The first phase of a human resources system (Eslabon) has been implemented (March '05) and the complete staff database will be finalized by the end of June '05. • We are currently implementing the project manager application of CIAT's system and plan to have an effective project management system in place during the 3rd quarter of '05. • Initial investigations have been made into a replacement financial management system
19. The Panel recommends that management carefully examine the correctness of the net assets (equity) balance for 2004 attributable to the increase in 2003 (of approximately US$ 2.0 million) from fixed assets write-off and revaluation.	CIMMYT notes this recommendation. Our external auditors have confirmed that, while the detail that was presented in the 2003 financial statements was less than clear, the treatment was correct.
20. The Panel recommends that the Board and management develop a set of financial indicators for measuring the Centre financial performance and health. The indicators should supplement those developed by the CGIAR System in close consultation with CGIAR Secretariat and Centre Finance Directors.	CIMMYT agrees with the recommendation. We have discussed and agreed upon a set of financial indicators at the March '05 Board meeting. These indicators are based on those developed by the CGIAR.
21. The Panel recommends that a full cost recovery/pricing system for support services be implemented to recover the full costs from projects and users of services. This will reduce the pressure on unrestricted funding and make it available for other high priority activities at the Centre, including building the working capital to the required level.	CIMMYT agrees with the recommendation and has already implemented changes within the 2005 budget that will lead to full cost recovery from projects and users of services. In addition, a costing template is being developed as part of Project Manager.
22. The Panel recommends that Board and management: *a. Make substantial efforts and allocate adequate time for the careful review of the external audit (at headquarters and regional operations), management letters and the audited financial statements with the notes;* *b. Carefully review the annual audit plans and scope of external audit for headquarters and regional operations;* *c. Formally assess annually the performance of the external auditors before deciding on their re-appointment.*	CIMMYT agrees and will commit substantial time and effort for the careful review of external audit reports for headquarters and regional offices. The BOT Audit Committee annually receives audit plans, and will review the external audit scope to reflect management's and the Board's assessment of risks, taking into account the changing nature of the Center's programs at headquarters and in the regions. The Audit Committee will develop and implement a formal plan for assessment of the External Auditors prior to renewal or selection of new auditors.
23. The Panel recommends that Board and management review the scope of internal audit work and the capabilities of the senior internal auditor and make the required changes to strengthen this important function.	The CIMMYT Board and Management agree that CIMMYT must have a strong internal audit function. The scope and capabilities of the internal audit function will continue to be under review and all necessary and appropriate actions will be taken during 2005.

MTP Project Narratives

Program 1: Genetic Resources

Crop-related biodiversity is the founding asset of the CGIAR and the basic raw material for the international breeding programs of CIMMYT. Program activities build on this foundation but with emphasis on bioscience-assisted methodologies to identify value added traits and introgress them rapidly into elite breeding material. Structured and well-characterized germplasm—introgression lines, enhanced genepools, genetic mapping populations, mutant stocks—are an increasingly critical asset. The targeted generation, intensive characterization, and extensive evaluation of these resources increasingly constitutes the rate-limiting factor for deriving tangible products for developing country farmers from the outputs of genomics and information technology. The Genetic Resources Program has a pivotal role in bridging the gap between upstream innovation generators and product development and delivery providers for resource-poor farmers.

Accomplishing this will depend more and more on effective data management systems. A major, new, strategic focus in the Program is the creation of a fully-integrated, web-based support system for the conservation, utilization, evaluation, and enhancement of crop genetic resources. Under the system being developed, all types of data can be integrated, compared, and collectively analyzed and/or queried by anyone, anywhere. The Program is working closely with the CGIAR Generation Challenge Program and within the IRRI-CIMMYT Alliance to build a global framework for releasing the value of cereal genetic resources.

The overall objective of the Program is developing and validating new methodologies to identify and manipulate alleles and genes for traits of importance for CIMMYT and partners in national research systems and small and medium enterprise (SME) breeding programs. The primary emphases include enhancing resilience to abiotic stresses, yield stability under biotic stress, and improving the nutritional quality of maize and wheat varieties through the targeted use of genetic resources. The Program is focusing on five central themes within an 80% demand-driven framework with 20% technology-driven, solution-searching activities, as described in the program logframe.

Based on the above, the Program is re-emphasizing several primary activities and terminating others. In particular, generic characterization of germplasm collections, non-specific genetic-base broadening activities, and genetic *in situ* conservation efforts will be replaced largely by phenotypic and molecular genetic characterization of targeted germplasm subsets, establishment of regional core (working) collections, targeted germplasm enhancement, and fostering targeted *in situ* landrace improvement and gene-flow analysis.

Program 2: Impacts, Targeting and Assessment Program

In an era of scarce resources, research planning should result in achievable priorities based on relevant and reliable data. To reduce poverty, agricultural research should be prioritized and targeted to areas and types of farm households where poverty is concentrated. Through strategic assessments of wheat and maize system improvements, both past and planned, the Impacts Targeting and Assessment Program (ITA) contributes to mission-effective maize and wheat improvement research at CIMMYT.

The main outputs of the ITA program are strategic global and local targeting mechanisms for, setting priorities and identifying impact pathways for improved livelihoods in maize- and wheat-based systems globally. We will achieve these outputs through the following contributions to CIMMYT's efforts:

- Strategic targeting mechanisms and policy analysis
- Understanding strategies for the sustainable management of genetic diversity and associated natural resources
- Methods of analysis and knowledge regarding the role of product quality in value chains and human nutrition
- Coordinated knowledge sharing and capacity building

The end users of ITA products and services are national agricultural research systems (NARS) in the broadest sense in developing countries, and CIMMYT germplasm managers, breeders, supporting science and technology businesses, and public organizations, notably senior policy and decision makers.

The expected impacts of the ITA program are: Increased local and global food supplies and food security and sustainable livelihoods for the maize and wheat sectors. The ultimate beneficiaries are the rural poor working in maize and wheat systems and consumers of maize, wheat and cereal-fed animal products. The Program collaborates closely with NARS of countries such as India, China, Brazil, Mexico, Ethiopia and South Africa, and with CGIAR Centers such as IFPRI, ICARDA, IRRI, and ILRI.

Program 3: African Livelihoods

The African Livelihoods Program utilizes the genetic enhancement of maize and wheat for traits of relevance in stress-prone environments and of benefit to the resource-poor, along with knowledge of maize- and wheat-based farming systems in eastern and southern Africa (ESA), to address the extreme socio-economic and biophysical challenges in sub-Saharan Africa (SSA).

Over 70% of the population in SSA depends on agriculture or related sectors. Maize is the most important staple and is grown predominantly by smallholder resource-poor farmers for food, feed, and to generate income. Highly variable rainfall—exacerbated by the impacts of climate change—and decreasing soil fertility and a wide range of crop diseases and pests are continuous threats to the resource-poor. Wheat affects national economies as an import commodity and, as a cash crop, may contribute to the economic development of smallholder farmers and small enterprises.

The program's research priorities are set in collaboration with sub-regional organizations, in particular ASARECA and SADC/FANR, taking into consideration the complementary strengths and expertise of other CGIAR centers and research and development organizations in SSA. As a result, the program:

- Develops and supports the dissemination of stress tolerant, more nutritious maize and wheat varieties that increase food and income security among resource-poor farmers in SSA and reduce the need for food aid
- Develops maize- and wheat-based options that increase marketing options for smallholder farming products and, through partnerships with other research institutions, integrates and scales them out into livelihoods systems in ESA
- Develops and scales out risk-averting, productivity-enhancing management practices that restore natural resources in maize- and wheat-based systems of ESA
- Stimulates the development of a more diverse and stable maize seed industry that is responsive to resource-poor farmers' needs (articulated as a specific goal based on input by the 5th EPMR, the 2004 CCER on Maize in Africa, and stakeholders)
- Contributes to the capacity building of partners involved in the maize and wheat research-extension-marketing continuum, following priorities set by sub-regional networks

Beneficiaries of the program's outputs are resource-poor farmers and decision makers, through NARS, NGOs and the private sector. The program works in partnership with several CGIAR centers (CIAT, ICRAF, ICRISAT, IFPRI, IITA, ILRI); contributes to several CGIAR system-wide initiatives (for example, the Systemwide Livestock Program) and challenge programs (Generation, Water and Food, HarvestPlus); supports NARS and NGOs in ASARECA and SADC; links with the private sector on seed dissemination and input/output marketing; and, collaborates with a wide range of ARIs globally including NRI-UK, Texas A&M University, the University of Hohenheim, and the Weizman Institute of Science.

Program 4: Rainfed Wheat Systems

Approximately 50 million hectares, or close to 50% of all wheat cultivated in developing countries, is sown under rainfed systems that receive less than 600 mm of rainfall annually and represent the most diverse ecologies in which wheat is grown, due to extremes of abiotic and biotic stresses. Some of the poorest and most disadvantaged wheat farmers live in rainfed areas of less than 350 mm annual rainfall and their livelihoods depend on income from wheat production. The negative consequences of climate change (increased drought incidence, heat extremes, and irregular rainfall distribution) will be particularly harmful in this agro-ecosystem. Nearly all wheat produced in these areas is for human consumption and, in many countries, wheat as a staple food provides from 40 to 60 percent of the daily caloric requirement.

The goal of the Program is to help assure food security and land conservation in rainfed wheat systems in Asia, North Africa, and Latin America.

The Program contributes to three CGIAR Challenge Programs: Generation, HarvestPlus, and Water and Food. The focus of the Program is on the development of high yielding wheat cultivars with resistance/tolerance to prevailing abiotic and biotic stresses, along with improved end-use quality characteristics. In addition, the Program aims to produce wheat germplasm that can tolerate climatic change through increased drought and heat tolerance. To elucidate sources and mechanisms of stress adaptive traits, the Program also undertakes physiological and genetic characterization of wheat germplasm and genetic stocks and the identification of new genetic diversity. Finally, the Program develops and promotes appropriate conservation agriculture technologies for more sustainable wheat-based production systems in the target areas.

Program priorities and pathways for impact are set through collaboration with Program 2, (Impacts Targeting and Assessment).

The users of the program's outputs include: farmers; consumers; scientists in NARS, IARCs and ARIs; NGOs; and, the private sector.

The program works closely with farmers and NARS in rainfed wheat production environments mainly in Asia and North Africa, together with ARIs and other CGIAR centers. All activities in the CWANA region are coordinated and agreed upon and implemented, where appropriate, through joint projects with ICARDA. The International Winter Wheat Improvement Program is a joint program of Turkey, CIMMYT and ICARDA.

Program 5: Tropical Ecosystems

Global demand for maize is projected to increase 50 percent over 1995 levels by 2020. Within the Tropical Ecosystem Program's mandate areas, demand for maize will increase 92% in South Asia, 62% in Latin America, and 46% in East and Southeast Asia, over the same period (IFPRI). Drought is the most widespread abiotic constraint and, together with soil infertility (including acidity, which affects more than 40% of the tropical areas worldwide), results in chronically low and variable yields for resource-poor maize farmers. Diseases are another important production constraint that may also compromise the safety of grain for human consumption. Malnutrition remains an unacceptable yet prevalent problem among the poor; for example, nearly half of south Asian children under five years old are moderately to severely underweight and stunted. Thus the objectives of the Tropical Ecosystems Program are to develop stress tolerant, nutritionally enhanced maize germplasm and to engage with partners to deliver these to farmers and households whose livelihoods depend critically on maize production.

The Program outputs are: stress tolerant maize germplasm, maize with enhanced grain quality, and networks/partnerships to effectively develop, evaluate, and disseminate these.

The end users of Program research products and services are maize farmers and consumers, and public and private sector agricultural research and extension entities.

The expected impact of the Program is: improved food security and livelihoods for maize farmers; an improved nutritional status in some populations of maize consumers; and the enhanced effectiveness of CIMMYT and its partners to achieve these impacts. The program collaborates closely with NARS in countries such as Brazil, China, Colombia, El Salvador, Indonesia, Mexico, Nepal, Nicaragua, Philippines, Thailand, and Vietnam, and with CGIAR centers including CIAT, IITA, and increasingly IRRI.

Program 6: lntensive Agro-Ecosystems

The Intensive Agro-Ecosystems Program aims to safeguard food security through sustainable intensification in densely populated areas where cropping systems are already intensive and complex and where a large number of the world's poor live. Farmers in these areas grow more than 45million hectares of spring wheat. Program researchers work through partnerships with NARS, sister CGIAR centers and other international centers, aiming to provide food and income security options for rural and urban households in Asia, North Africa, and Latin America. These systems are central to reducing poverty in Asia, which still has the largest aggregate number of poor people in the world. Intensive systems are usually irrigated and highly productive, featuring multiple crops (including large areas of maize and wheat) and livestock. They also face serious problems, including the exploitation of water and soils, inefficient use of chemical inputs, and emerging or worsening disease and pest problems. The Program conducts research to overcome these limitations and to ensure that the key agricultural areas remain productive and ecologically sound into the future.

Farmers in these areas tend to be more market-oriented and driven by the need to sustain local communities and neighboring cities. Focus regions include the Indo-Gangetic Plains, the Mediterranean Littoral, the Yellow River Basin, and northwestern Mexico. Maize is an important component of the cropping systems in many areas where intensive agriculture is practiced and where there is an increasing demand for maize both for food and feed. Maize in intensive systems usually has adequate soil moisture (either assured irrigation or good rainfall distribution) and is grown in productive soils where farmers are willing to apply inputs, if the returns justify the investment. Approximately 20 million hectares are grown under subtropical and mid-altitude environments, a major portion of which come under intensive agro-ecosystems mainly in South Asia (India, Pakistan, Bangladesh and Nepal), China, Afghanistan, Mexico (Bajio, the Pacific Coast), southern Brazil, and northern Argentina.

The mission of the Program is to undertake research, through partnerships, that promotes intensive maize and wheat cropping systems that improve rural incomes and livelihoods through agro-ecosystem productivity and diversity, while minimizing unfavorable environmental impacts of farming. Beyond a focus on higher grain yield and value-added wheat and maize, the Program will seek to develop germplasm that uses water and other inputs more efficiently, lower production costs, manage biotic stresses, and enhance system diversity.

Program 7: The Rice-Wheat Consortium – a NARS-CGIAR Ecoregional Program

The Rice-Wheat Consortium for the Indo-Gangetic Plains (RWC) addresses issues of this intensively-cultivated, irrigated cropping system from which more than 300 million people in South Asia derive their livelihoods and food security. The RWC emerged from years of collaborative research among CIMMYT, IRRI, and the national research systems of Bangladesh, India, Nepal, and Pakistan. In 1994, with funding from IFAD and other donors, the RWC was established as an eco-regional initiative of the CGIAR and, in 1998, CIMMYT took on responsibilities as convening center. Funding has been generously supplied by DGIS of the Netherlands, ADB, DFID, IFAD, USAID, ACIAR, NZAID of New Zealand, and the World Bank through the CGIAR. Research partners include advanced research institutes such as Cornell University; Ohio State University; IACR-Rothamsted; AVRDC; IAC-Wageningen; CABI-UK; CSIRO, Australia; Melbourne University; CIRAD, France; DMC; and IAEA. Other international centers have provided key inputs—ICRISAT on legumes for crop rotations; CIP on potato.

RWC Structure and Operational Mechanisms. The Regional Steering Committee is chaired by a chief executive from a national research system. Committee members include the directors general of the national systems, of IRRI, and of CIMMYT, and a donor representative. The Consortium Facilitator/and Co-facilitator act as Secretary/and Co-secretary. A Regional Technical Coordination Committee, which helps formulate programs, is made up of the national rice-wheat coordinators, focal scientists from participating CGIAR centers, and representatives of advanced institutes and NGOs. There are national steering and technical coordinating committees in each of the four countries and site teams to coordinate local implementation.

A Successful, NARS-Driven Initiative. A TAC-commissioned review of Ecoregional Programs noted that, "The RWC is clearly a NARS-driven initiative with the Centers largely having roles defined by the Consortium . . ." Among the notable achievements of the RWC are fostering partnerships and strengthening stakeholder participation. APAARI chose the RWC as their "best example of an effective research partnership" for presentation at GFAR, and in 2000 the Consortium received the CGIAR Chairman's “Award for Outstanding Scientific Partnerships.” In recognition of its contributions to productive, ecologically-friendly agriculture among the poor in Asia, the RWC was given the prestigious King Baudouin Award of the Consultative Group on International Agricultural Research (CGIAR) in 2004.

Outlook. The success of the RWC in promoting zero-tillage for sowing wheat after rice harvest (as of 2004, used on more than 1.3 million hectares) has served as a platform for the promotion and testing with farmers of a suite of resource-conserving practices, such as land leveling, raised beds, direct seeded rice, residue management, and intercropping systems. National researchers and CIMMYT are monitoring the effect of the new practices on water savings. The Consortium is also helping farmers to diversify with crops such as quality protein maize, pigeonpea, mungbean, chickpea, lentil, faba beans, potatoes and vegetables.

MTP Project Logframes

Program 1: Genetic Resources

Outputs	Intended User	Outcome	Impact
Output 1. Global custodianship, characterization and management of the genetic resources of maize, wheat and related species	CIMMYT, IARCs, NARS, ARIs, SME researchers and breeders	Improved access to and utilization of novel traits with value for improving resilience (to abiotic stresses), yield stability (under biotic stress) and nutritional value	More market preferred varieties that reduce farmer risks and vulnerabilities, improve farming household livelihoods and health, and, conserve natural resources
Output Targets 2006 • Phenotypic data on at least 25,000 maize accessions available for up to 30 passport and characterization traits • A fully integrated web-based genebank information, management and distribution system for all maize and wheat germplasm (with SGRP) • A 5-10% increase in the number and type of maize and related species accessions available in the genebank from Latin America, Africa and Asia		A 5% increase in the number of requests for maize accessions. More than 80% of maize germplasm FAO designated More than 3M passport and characterization data points available for maize and wheat genebank accessions that can be interrogated through a range of web-based query and analysis tools A 3-5% increase in the amount of maize genetic diversity captured in the genebank as assessed by phenotypic and/or molecular genetic parameters	Improved utilization of maize genetic resources in research and breeding programs worldwide More information available with easier access and analysis possible for wheat and maize germplasm users across the world Increased genetic and trait-based diversity available for maize research and breeding programs worldwide
Output Targets 2007 • Phenotype data on at least 75,000 wheat and related species accessions available for up to 25 passport and characterization traits • 2-3 geographic/ environmental, molecular genetic and/or trait-based core sub-sets of both maize and wheat germplasm collections available		A 5-10% increase in the number of requests for wheat accessions (germplasm and genetic stocks) At least 100 requests for CIMMYT targeted core collections or self-selected mini-core collections (using web-based selector system)	Improved utilization of wheat genetic resources (including synthetics and other genetic stocks) in research and breeding programs worldwide Improved utilization of wheat and maize genetic resources in research and breeding programs worldwide
Output Targets 2008 • Targeted phenotyping and molecular characterization of 5,000 accessions of maize and wheat sub-set collections		A 25% increase in the number and/or value of new alleles and genes with importance for priority agronomic, quality traits	Increased number of better characterized and more useful genetic resources for research and breeding programs worldwide
Output 2. Improved methodologies for the identification and utilization of useful maize and wheat germplasm for traits prioritized by end users	CIMMYT, IARCs, NARS, ARIs, SME researchers and breeders	More and better new alleles and genes identified for priority traits and introgressed into elite agronomic backgrounds identified by end-users	More market preferred varieties that reduce farmer risks and vulnerabilities, improve farming household livelihoods and health, and, conserve natural resources

Outputs	Intended User	Outcome	Impact
Output Targets 2006 • Key markers from consensus maps for drought tolerance in maize independently validated • Useful maize and wheat germplasm developed with traits defined by NARS, SME and CIMMYT regional breeding programs such as drought tolerance and resistance to diseases and pests • Genetic engineered component contributions to drought tolerance in wheat and insect pest resistance in maize evaluated under field conditions in 3-5 countries across Latin America, Africa and Asia		Validated markers available for genes conferring more than 50% of phenotypic variation and providing a 2-fold increase in selective power More than 50% of elite wheat lines and more than 25% of elite maize lines containing novel alleles or genes derived from landraces/wild relatives/novel genepools providing enhanced drought tolerance and/or pest and disease resistance Field quantification of the positive effect of single gene insertions for drought tolerance in wheat and insect pest resistance in maize plus associated national biosafety legislation requirements fostered and/or fulfilled for field release	More efficient marker-assisted selection of drought tolerance in maize More market preferred varieties that reduce farmer risks and vulnerabilities, improve farming household livelihoods and health, and, conserve natural resources More market preferred varieties that reduce farmer risks and vulnerabilities
Output Targets 2007 • Identification of new alleles and genes through association mapping and or functional genomics analysis for key economic traits identified by maize and wheat end-users • Consensus maps generated from at least 5 different populations and/or environments for resistance to Fusarium head blight and rust in wheat and for insect pest resistance in maize • Informatics methodologies developed to assist with the efficient identification and investigation of alleles and genes contributing to priority target traits in maize and wheat • Logistical and statistical improvements, and simulation models for efficient genebank expansion, maintenance and regeneration developed • Low-copy and selectable marker-free events of the most effective constructs for target traits produced		Gene-based or linked markers generated for novel allelic and genetic variation conferring improvement in important key agronomic traits in maize and wheat Markers available for genes contributing more than 50% of the phenotypic variation for resistance to Fusarium head blight and rust in wheat, and for insect pest resistance in maize Targeted methodologies available for the efficient identification and investigation of alleles and genes contributing to at least 5 priority traits in maize and wheat A 15% improvement in the cost efficiency of managing genetic diversity of maize and wheat collections, and better structured collections leading to increased utilization Highly efficient gene excision/recombination system for maize and wheat developed	More rapid and efficient identification of new markers for immediate use in molecular breeding of drought tolerance and biotic stress resistance More efficient marker-assisted selection of Fusarium head blight and rust in wheat, and for insect pest resistance in maize More efficient methodologies for identifying and validating useful alleles and genes for improvement of priority traits identified by end-users Better, more cost-effective management of maize and wheat genetic resources, more rapid and better targeted access for end-users New varieties that reduce farmer risks and vulnerabilities while better attending to consumer concerns

Outputs	Intended User	Outcome	Impact
Output Targets 2008 • Development and validation of fast-track breeding techniques: marker-aided introgression, marker-assisted selection, marker-accelerated backcross breeding and double haploid production		A 75% reduction in the unit cost and a 10-fold increase in the throughput of molecular breeding services at CIMMYT hubs in Latin America, Africa and Asia. A 5-fold increase in the use of double haploids in winter wheat breeding programs	More efficient and rapid methodologies for breeding market preferred varieties that reduce farmer risks and vulnerabilities, improve farming household livelihoods and health, and, conserve natural resources
• Useful maize and wheat germplasm with enhanced abiotic stress tolerance, resistance to pests and diseases, and improved nutritional quality developed		More than 75% of elite maize and wheat breeding products with a landrace or wild relative present in their pedigree providing enhanced abiotic stress tolerance and/or biotic stress resistance	More market preferred varieties that reduce farmer risks and vulnerabilities, improve farming household livelihoods and health, and, conserve natural resources
• A fully integrated web-based crop information system for all maize and wheat germplasm enhancement and breeding data linked with statistical and simulation methodologies developed to assist with the efficient manipulation of new alleles and genes in maize and wheat (with SGRP)		Data management and decision support systems software to improve efficiency with which breeding programs utilize crop information in breeding, particularly for complex target traits with high epistasis and genotype-by-environment interaction	More efficient methods available for breeding programs across the world targeting market preferred varieties that reduce farmer risks and vulnerabilities, improve farming household livelihoods and health, and, conserve natural resources
Output 3. Capacity in genetic resources management, maintenance and use enhanced globally	NARS and SME researchers and breeders, and farmers	Latest innovations and best practices in germplasm management, utilization and enhancement adopted, refined and further widely disseminated	More market preferred varieties that reduce farmer risks and vulnerabilities, improve farming household livelihoods and health, and conserve natural resources
Output Target 2006 • At least 50 staff trained in at least one new technology, methodology or best practice per year		Latest innovations in germplasm management, utilization and enhancement adopted	More market preferred varieties that reduce farmer risks and vulnerabilities, improve farming household livelihoods and health, and, conserve natural resources
Output Targets 2007 • Establishment of core collections with 5-10 NARS partners in key target regions across Latin America, Africa and Asia	CIMMYT regional programs with NARS researchers and breeders	Greater depth and breadth of genetic resources utilization in regional maize and wheat breeding programs	More market preferred varieties that reduce farmer risks and vulnerabilities, improve farming household livelihoods and health, and, conserve natural resources
• *In situ* maize landrace improvement programs fostered in 3-5 key regions in Latin America with associated monitoring of gene-flow		Introgression of required agronomic traits into preferred local backgrounds and improved understanding of local and regional geneflow dynamics	More market preferred varieties that reduce farmer risks and vulnerabilities, improve farming household livelihoods and health, and, conserve natural resources

Outputs	Intended User	Outcome	Impact
• Molecular breeding communities of practice generating cooperatively designed and developed seed-based technologies in each mega-environment targeted for maize and/or wheat	CIMMYT regional programs with NARS and SME research and breeding programs working in-house or through regional hubs in Latin America, Africa and Asia	A 2-fold increase in the number of NARS and SME breeding programs actively participating in cooperative community activities, including the application of molecular tools and other best practice techniques for rapid and targeted crop improvement	More rapid development of market preferred varieties that reduce farmer risks and vulnerabilities, improve farming household livelihoods and health, and, conserve natural resources

Program 2: Impacts, Targeting and Assessment

Outputs	Intended user	Outcome	Impact
Output 1. Strategic targeting mechanisms and knowledge for priority setting for maize and wheat system improvement and the identification of enabling policies	Managers and scientists in NARS, CIMMYT, CGIAR and associated partners, agricultural policy makers and donors	Better priority setting and targeting of research and policy dialogue for maize and wheat system improvement, especially for poor farmers	Increased effectiveness and focus of research and improved policy environments for maize and wheat system development for improvement of rural livelihoods, including enhanced resources and food security and reduced poverty
Annual Output Targets 2006-2008 • Individual professional development opportunities such as BSc / MSc / PhD thesis research, sabbatical stays, visiting scientists' stays, internships, etc. • Global (1), regional (3) or sub-regional (10) networks initiated, promoted, supported and/or guided by CIMMYT, e.g., Soil Fertility Consortium for Southern Africa.	NARS, CGIAR centres (IIRI, ICRAF, WARDA), universities, donors	Enlarged and stabilized regional and international pool of skilled researchers. Effective resource mobilization and collaboration between CIMMYT and partners on different levels.	Consolidated capacity of CIMMYT partners to conduct effective cutting-edge research towards development of maize- and wheat-based agricultural systems
Output target 2006 • Ex ante/ex post impact assessment platform, methods, and capacity in CIMMYT which support assessments with 4 NARS of drought tolerant wheat in two regions • Initiation of the next global maize impacts study in partnership with NARS and private industry • Global ex ante impact assessment of a fusarium head blight (FHB or scab) epidemic • Workshop on institutional learning/targeting mechanisms to strengthen priority setting mechanisms in CIMMYT, NARS and associated partners • Developed methods and integrated geo-spatial databases and knowledge bases on impact and innovation pathways, livelihood patterns and dynamics to support targeting for: Maize mixed farming systems in East & Southern Africa and the Rice-wheat farming systems in South Asia.	Managers and scientists in NARS, CIMMYT, CGIAR community and seed company managers and scientists	Capacity reinforced in 6 CIMMYT Programs and 4 selected NARS to carry out impact assessments in two main regions. Knowledge and databases available on impact pathways in 2 regions. Improved conditions for institutional learning/targeting linked to impact assessments.	Improved knowledge of impact and innovation pathways of maize and wheat research in 2 regions. Improved institutional learning/targeting mechanisms.
Output target 2007 • Ex ante impact assessment of virulent new rust strains on wheat systems and livelihoods in Eastern Africa, Middle East and South Asia • Ex post assessments of drought tolerant maize with 4 selected NARS in marginal areas of 2 regions (East and Southern Africa and Asia) • Establishment of integrated geo-spatial databases and knowledge bases on impact pathways, livelihood patterns and dynamics covering 80 % of maize and wheat farming systems in developing countries	Policy-makers, NARS, CIMMYT and Challenge and System-wide Program scientists and managers, donors community	Improved basis for designing responses to rust in 3 regions, including South Asia. Increased capacity for impact assessment in 4 more NARS. Comprehensive integrated knowledge bases on dominant impact pathways and spatially disaggregated data bases for 80% of maize and wheat in	More effective breeding for wheat rust. Increased reliance on internal expertise for impact assessment in 4 selected NARS. More effective maize and wheat system research in 4 regions. Improved policy environment for wheat value chains.

Outputs	Intended user	Outcome	Impact
• Farm, local and meso-level analyses of key policy bottlenecks and required improvements for wheat adoption and marketing with partners including NARS and CG Centers (e.g., IFPRI) in two regions		developing countries accessible and available. Enriched policy dialogue on impact pathways for wheat germplasm and technologies in 2 regions.	
Output Target 2008 • Two ex ante impact assessments, of drought tolerant maize and drought tolerant wheat, across marginal areas in 4 regions • Two local in depth analyses of impact pathways, for wheat in rainfed wheat systems (WANA/CAC) and maize (Central America) • Farm, local and meso-level analyses of policy bottlenecks and required improvements for maize adoption and marketing with NARS and CG Centers (e.g., IFPRI) in E & S Africa and Asia • Support to priority setting for maize and wheat germplasm enhancement.	Policy makers, NARS, CIMMYT and Challenge and System-wide Program managers and scientists, donor community	Better understanding of the role of drought tolerant maize and wheat germplasm in risk management in marginal areas in 4 regions. Improved knowledge of livelihoods and local interventions related to wheat and maize impact pathways in 2 areas in 2 regions. Enriched policy dialogue on impact pathways for maize germplasm and technologies in 2 regions. Identified priorities for germplasm enhancement.	More effective maize and wheat breeding for drought tolerance. Improved impact and innovation pathways for maize & wheat research. Improved policy environment for wheat value chains.
Output 2. Analyses and appraisals of local sustainable management of genetic diversity and other natural resources for crop management	Development agents, NGOs, NARS, local development agencies	Better understanding of diversity and resource management development interventions in selected wheat and maize based farming systems	Improved development interventions for sustainable conservation, management and utilization of natural resources and genetic diversity in selected locations in wheat and maize based systems
Output Targets 2006 • Study of household choice and local crop genetic diversity in 2 systems: maize in Mexico; and wheat in Turkey • Synthesis of appraisals of sustainable intensification of agriculture and the non-farm economy in 6 cereal based farming systems in Africa, Asia and Latin America	Policy makers (Ministries of Agriculture and Environment), NGOs, CGIAR & NARS scientists	Deeper understanding of household incentives, feasibility of in situ conservation and sustainable intensification dynamics in 3 regions	Improved interventions for *in situ* conservation and sustainable intensification
Output Targets 2007 • Assessments of community seed systems in poor areas of South East Asia, Uganda and Central America • Regional appraisals of conservation agriculture in 2 regions (Southern Africa/Zambia, maize) and South Asia/India, rice-wheat)	NGO and Ministry development agents, and NARS scientists	Lessons from functioning community seed systems and productive conservation agriculture in 3 regions	Strengthened interventions for the development of local seed systems and improvement of natural resource management
Output Targets 2008 • Appraisals of dryland resource management and conservation agriculture in Yellow River Basin, China • Global synthesis of appraisals of conservation agriculture across 3 regions (Asia, Africa and Latin America) • Appraisals of climate change impact on maize and wheat farming systems, such as: poor regions of Central America (maize), CWANA (wheat) and Asian uplands (rice-maize)	Farmers, scientists (NARS, universities, CGIAR), policy makers (Ministry of Agriculture & Water Resources), Challenge Programs	Profitable resource management and farming system diversification options developed and adapted in 4 provinces Deeper understanding of likely response options for farming systems to climate change	Improved approaches to land and water use efficiency in order to decrease effect of wind and water erosion and increase productivity and sustainable management, in the short and long run

Outputs	Intended user	Outcome	Impact
Output 3. Analyzed and documented roles of grain quality (micro-nutrients, protein, cleanliness) in the improvement of livelihoods of the poor rural households in 3 selected poor wheat and maize systems	Private sector policy makers, partners (including NGOs), CGIAR Centers	Improved interventions based on high protein maize varieties, micro-nutrient enriched wheat varieties and value-added chains in selected maize and wheat farming systems	Enhanced human nutrition through micro-nutrient-enriched grain and increased incomes/employment through improvements in value chain coordination and efficiency in poor wheat and maize areas
Output Targets 2006 • Documented value chains for maize systems in poor areas of Latin America (building on CIAT's agro-enterprise work) and maize marketing systems in Southern Africa • Ex-ante impact of Zinc-enriched wheat varieties on micro-nutrient deficiency in Eastern UP (India), Punjab and Pakistan	CGIAR Centers (e.g., CIAT), business (livelihood) service providers, NGOs, International Labour Organization (ILO), HarvestPlus	Better understanding of the role of quality in value chains in 2 regions and human nutrition in 2 regions and how those value and nutrition chains can be made to work for effectively and efficiently for farmers and value-added enterprises e.g. agro-processing.	Improved value chains leading to increased financial capital for smallholder farmers and others in the value chains Improved health for different end-users
Output Targets 2007 • Documented value chains for poor wheat area in South Asia, e.g., East UP (India) and poor upland maize area in South East Asia • Methodology developed and tested to assess potential benefits of QPM maize on human health in selected poor regions of Central America	NARs, CGIAR centers private sector, small enterprise and market development sectors, NGOs	Greater understanding of constraints and opportunities within the value and nutrient chains (one region each). Identification of service providers to make value chains work better	Improved functioning of value chains leading to increased financial capital for value chain actors, especially smallholder farmers
Output Targets 2008 • Ex-ante impact of bio-fortified maize varieties on micro-nutrient deficiency and livelihoods in Eastern Africa; and assessment of QPM maize in Central America • Documented value chains for marginal wheat systems in Central Asia	Health and education (school meals) policy makers, partners	Identification of potential health and other livelihood benefits from improved functioning of wheat value and nutrient chains in 2 regions	Improved nutrition of end-users, greater income for wheat producers in Central Asia
Output 4. Strengthened partners involved in research and development of maize- and wheat-based systems in conjunction with other CIMMYT Programs	NARS, CGIAR, NGOs, policy makers, donors, universities, international organizations, public and private sector entities	Human resource capacity to improve maize- and wheat-based farming systems strengthened. Impact, and accessibility to information, knowledge and technology developed by CIMMYT and partners enhanced. Functional collaboration among CIMMYT and partners towards the common goal of food security and improved livelihoods maximized.	Strengthened partners' capacity to conduct appropriate R&D towards sustainable NRM and poverty alleviation on regional and global level.
Output Targets 2006 • Identify partners, conceptualize and design information portals (cereal knowledge bank) • Mapping and review of regional/international and inter-institutional partnerships (networks) • Conduct of appraisals/workshops on knowledge sharing and institutional learning	CGIAR (IRRI), universities, international organizations, donors, NARS	Identified and analyzed conditions for improved information and knowledge sharing (within and outside CIMMYT) and networking.	Improved information and knowledge sharing and networking

Outputs	Intended user	Outcome	Impact
Output Targets 2007 • Implementation and population of portals (cereal knowledge bank) • Geographical and thematic assessment of capacity building needs finalized.	CGIAR (IRRI), NARS, NGO's, universities, international organizations, donors	CIMMYT partners' scientific capacity enhanced through availability of wheat and maize systems knowledge, functional information flow and efficient collaboration	Increased research effectiveness of CIMMYT partners especially in the key regions.
Output Targets 2008 • Cereal knowledge bank fully populated and operational	NARS, NGO's, universities, donors, policy makers	CIMMYT capacity building strategy/plan updated – targeting, prioritization, efficiency	Reviewed CIMMYT capacity building activities targeting, effectiveness and success

Program 3: African Livelihoods

Outputs	Intended User	Outcome	Impact
Output 1. Stress tolerant, more nutritious maize and wheat varieties that increase food and income security among resource-poor farmers in Sub Saharan Africa (SSA)	Resource-poor farmers through NARS and private seed companies	Maize and wheat varieties become available that address livelihood concerns of resource-poor farmers in sub-Saharan Africa (SSA)	Increased food and income security for resource-poor farmers and countries in Sub Saharan Africa (SSA)
Annual Output Targets 2006-2008			
• Four CIMMYT maize lines and six regionally important open pollinated varieties (OPVs) or hybrids developed, targeting the main agro-ecologies in Eastern and Southern Africa	NARS and private seed companies	Increased use of elite maize germplasm carrying traits relevant to resource-poor farmers with associated emergence of small seed entrepreneurs in SSA	Productivity increases among resource poor farmers in ESA; diversification and expansion of the seed sector
• Regional trials documenting the performance of new hybrids and OPVs developed by the private and public sector in ESA for traits relevant to resource-poor farmers	NARS, NGOs, private seed sector, organizations involved in seed relief	Increased awareness and use of new maize varieties carrying traits that are beneficial to resource-poor farmers	Productivity increases in particular among resource-poor farmers in ESA
• International wheat nurseries accessed by collaborators in SSA	NARS in SSA	New wheat varieties become available in SSA	Productivity increases, reduced wheat imports, lower wheat prices
Output Targets 2006			
• Seed of drought and nitrogen stress tolerant maize OPVs reaches farmers on 1M ha in SSA	Resource-poor farmers in stress-prone environments	Reduced impact of drought on maize yields in resource-poor farmers' fields; increased seed security of resource-poor farmers due to the availability of improved OPVs	Reduced need for food-aid
• *Striga* resistant (IR) maize seed available in Kenya	Resource-poor farmers in *Striga*-affected areas	Restoration of maize production and depletion of *Striga* seed banks in *Striga* affected areas in Kenya	Increased food security of resource-poor Kenyan farmers
• Maize varieties with stem borer resistance released in Kenya	Farmers in Kenya	Technology option for areas with high stem borer incidence in Kenya; reduced need for insecticides.	Increased food security among resource-poor Kenyan farmers
• Extent of the stem rust problem in ESA assessed and strategies for the deployment of varieties with better resistance developed	NARS, wheat growing countries worldwide	Measures to address global stem rust threat in wheat initiated	
Output Targets 2007			
• New drought tolerant, N-use efficient, responsive maize hybrids and farmer-selected OPVs released in several ESA countries	Farmers in stress prone-environments in ESA	Reduced impact of drought on maize yields and national maize production; improved viability of seed industry in stress-prone areas	Reduced need for food-aid

Outputs	Intended User	Outcome	Impact
• *Striga* resistant (IR) maize seed grown by farmers on 20,000 ha in Kenya	Resource-poor farmers in *Striga*-affected areas	Restoration of maize production and depletion of *Striga* seed banks in *Striga* affected areas in Kenya	Increased food security of resource-poor Kenyan farmers
• More productive, farmer-selected maize highland varieties released in two eastern African countries	Resource-poor farmers in the highlands	Improved varieties with earlier maturity and increased disease resistance	Increased food security in the highly populated highlands of eastern Africa
• At least 4 farmer-grown maize varieties replaced with high lysine (QPM) versions of the same varieties	Farmers in eastern and southern Africa	Increasing area of maize grown to QPM	Reduced risk of protein malnutrition in particular among women and children
Output Targets 2008 • Drought tolerant quality protein maize (QPM) varieties developed	NARS and private seed companies	Technology option that impacts on food security and malnutrition of population groups most at risk	Reduced need for food-aid
• *Striga* resistant (IR) maize varieties released in at least 4 SSA countries	Resource-poor farmers in *Striga*-affected areas	*Striga* resistant maize varieties become available in an increasing number of SSA countries	Increased food security of resource-poor farmers
• CIMMYT/KARI-developed Bt maize varieties enter national maize variety trials in Kenya	NARS in Kenya	Technology option for areas with high stem borer incidence; reduced need to apply insecticides.	Increased food security among resource-poor Kenyan farmers
• Stem rust resistant wheat varieties pre-released in Kenya and Ethiopia	Wheat farmers in Ethiopia and Kenya	Wheat varieties combating the threat of crop failure due to stem rust	Reduced need for wheat imports
Output 2. Maize- and wheat-based systems that increase marketing options for smallholder farmers	Farmers through NARS, NGOs and other farmer support groups	Farm-level productivity increases, environmental sustainability and diversification of maize- and wheat-based systems in ESA	Economic development of poor rural maize and wheat-growing communities in ESA
Output Targets 2006 • QPM varieties released in eight SSA countries	Farmers in ESA	Increased availability of elite QPM varieties	Improved incomes; increased farm level productivity from QPM-fed non-ruminants
Output Targets 2007 • Publications highlighting the effects of QPM on community health indicators and impact as animal feed in selected regions of ESA	NARS, NGOs, policy makers, donors, farmers	Targeted use of QPM in food relief programs and as livestock feed	Improved human health and increased income of maize-livestock producers
• Dual-purpose maize varieties identified for use in maize-livestock systems in eastern Africa	NARS, farmers in maize-livestock systems	Information on the fodder value of maize varieties in eastern Africa	Maize-livestock producers increase productivity

Outputs	Intended User	Outcome	Impact
• Aflatoxin resistance of maize varieties documented	NARS, governments in ESA countries, maize consumers	Knowledge of aflatoxin status of maize varieties; strategy for breeding resistance	Improved human health
• Output Targets 2008 • QPM seed available for 250,000 ha in ESA	Farmers interested in contract farming and live-stock maize systems	Contract production of QPM grain for food relief and as stock feed; increased farm level productivity from QPM-fed non-ruminants	Increased income of maize-livestock producers
Output 3. Risk-averting, productivity-enhancing management practices that restore natural resources in maize- and wheat-based systems of ESA	Public and NGO extension staff and farmers	Wider use of sustainable management practices by smallholder farmers in ESA	Environmental sustainability and increased productivity of maize- and wheat-based systems in ESA
Annual Output Targets 2006-2008 • Development, demonstration and scaling-out of productivity-enhancing maize and wheat cropping practices in at least 8 ESA countries	NARS and NGOs	Increased use of, and farmer experimentation with resource-conserving maize and wheat cropping practices	Improved livelihoods of resource-poor farmers in a more sustainable environment
Output Targets 2006 • Maize systems synthesis for conservation agriculture (CA) in ESA • Options and strategies promoted that increase the productivity and profitability of maize-based cropping systems in Zimbabwe.	NARS, NGOs, IARCs, ARIs NARS, NGOs and input suppliers in Zimbabwe	Smallholder farmer experimentation initiated in 4 ESA countries More effective implementation of food security programs in Zimbabwe	 Productivity increases and more sustainable and profitable use of natural resources
Output Targets 2007 • Recommendations for improved CA practices in four countries in ESA defined • Appropriate water-conserving technologies to increase crop productivity in the Limpopo basin	NARS, NGOs, IARCs, ARIs NARS, NGOs, IARCs, ARIs	Methods to facilitate the scaling up and adoption of CA practices Promotion of water-conserving technologies among smallholder farmers in the Limpopo basin	Improved environmental sustainability Reduced vulnerability to low-rainfall conditions
Output Targets 2008 • Specific CA practices identified for smallholder farmer groups in ESA.	Smallholder farms in maize-based systems in ESA	Resource-conserving crop management practices; more efficient water-use by crops	Increased incomes; reduced need for labour
Output 4. More diverse maize seed sector in ESA responding to resource-poor farmers' needs	NARS, small-scale seed entrepreneurs, NGOs, policy makers	More sustainable production and marketing of seed in outlying areas.	Sustainable reduction of poverty and hunger
Annual Output Targets 2006-2008 • Breeder and foundation seed production of regionally relevant public maize OPVs • Technical and financial backstopping of maize seed sector in six ESA countries	NARS, NGOs, seed producers NARS, small-scale seed entrepreneurs, NGOs, policy makers	Improved maize seed for resource-poor farmers Coordinated public-private strategies that increase farmers' access to improved maize seed	Increased productivity and reduced vulnerability of resource-poor farmers Productivity increases in particular among farmers in outlying areas

Outputs	Intended User	Outcome	Impact
Output Targets 2006			
• Information on barriers that prevent small-scale, resource-poor farmers from acquiring improved maize seed	Policy and decision makers in ESA countries	Increased awareness of barriers hindering resource-poor farmers' access to improved maize seed	
• Issue papers and technical information on the regionalization of seed laws and regulations	Policy and decision makers in ESA countries	Progress in regionalizing seed laws and regulations in ESA	More rapid and wide-spread access of farmers to seed of new crop varieties
Output Targets 2007			
• 15 small-scale seed entrepreneurs trained in practical seed business skills relevant to initiate successful (maize) seed businesses in ESA	Small-scale seed entrepreneurs	Increase success rate among emerging seed entrepreneurs	More wide-spread access of farmers to seed
• Information describing price risk and the role of OPVs versus hybrid seed for farmers' livelihood and seed sector development	NGOs, donors and decision makers	More appropriate choice of strategies that increase farmers' access to improved seed and foster seed sector development	Sustainable seed sector development
Output Targets 2008			
• Mentoring of ten small-scale seed entrepreneurs and community-based seed enterprises	Small-scale seed entrepreneurs	Emerging seed companies making a significant impact on the seed market using public maize varieties.	Productivity increases among smallholders and the resource-poor
Output 5. Capacity building of partners involved in the maize and wheat research-extension-marketing continuum	NARS, small-scale seed entrepreneurs, NGOs, policy makers	Institutions and collaboration among development partners in ESA strengthened	Sustainable reduction of poverty and hunger
Annual Output Targets 2006-2008			
• Skills of 50 NARS scientists improved, prioritized within regional networks	NARS scientists	Increased effectiveness of NARS scientists in addressing high priority needs of resource-poor maize and wheat farmers in ESA	
• Technical and financial support of 100 farmer-participatory research and extension groups prioritized within regional networks	NARS and NGOs	Regional collaboration on priority research topics addressing the needs of resource-poor maize and wheat farmers in ESA	
• Development of regulatory skills for deployment of GM crop varieties in Kenya	Regulatory authorities in Kenya	Increased ability to assess GM technology options for potential use in Kenya	Reduced productivity losses to pests

Program 4: Rainfed Wheat Systems

Outputs	Intended user	Outcome	Impact
Output 1. Wheat germplasm developed and exchanged	Farmers, household consumers, food processors, NARS, IARC ARI, NGOs, private sector	Measurable increase in productivity and genetic diversity in farmers' fields; reduced losses from diseases and increased stability of grain yield; enhanced input efficiency	Increased national food security; reduced vulnerability of farm families whose livelihoods depends on wheat-based farming systems; improved agricultural productivity, better quality of wheat products and more sustainable utilization of natural resources
• **Annual Output Targets 2006 – 2008** • Advanced spring and winter bread and spring durum wheat lines (750) and segregating populations (300) with tolerance to abiotic (drought, heat, cold, nutrient deficiencies), and biotic stresses (rusts, septoria, fusarium, tan spot, root rots, nematodes) with enhanced seedling vigor and better end-use quality		Valuable lines and segregating populations used in breeding programs. Data from international wheat improvement network (IWIN) available to co-operators	Improved and genetically diverse wheat germplasm used by breeders. Faster development of improved varieties. Participation in global and regional wheat improvement networks increases. Global monitoring and pre-emptive screening against new diseases and new virulences before major epidemics occur
• At least 150 advanced wheat lines tested by partners in multi-locational yield trials.		Cultivars characterized for relevant traits. Lines and data used for wheat improvement. Cultivars evaluated by farmers through participatory varietal selection	Germplasm and information sharing and analysis lead to faster deployment of improved varieties and increased productivity
• Candidate lines (40) submitted for national cultivar registration trials. Seed available for formal and informal multiplication.		Ten cultivars released and adopted by farmer for areas affected by erratic rainfall	Farmers and consumers benefit from new wheat varieties. Enhanced drought and heat tolerance of these varieties buffer against possible negative effects from climate change
Output 2. Tapping new genetic diversity for rainfed wheat production: Wheat germplasm characterized for stress-adaptive traits with emphasis on drought and heat and resistance to diseases, with emphasis on soil borne diseases.	NARS, IARCs, ARIs	New valuable gene(s) identified and incorporated into breeding lines	Livelihoods of farmers living in marginal areas enhanced through more drought tolerant and stress resistant cultivars. Measurable increase in productivity, genetic diversity in farmers' fields
Annual Output Targets 2006 – 2008 • Understanding and identification of main physiological and morphological traits associated with drought and heat tolerance in synthetics, landraces and various mapping populations.		Enhanced knowledge and applied tools. Increased selection efficiency	Better drought and heat tolerant varieties delivered faster to farmers

Outputs	Intended user	Outcome	Impact
• New sources (5) of wheat root disease resistance to nematodes and/or root rots prevalent primarily in rainfed wheat systems identified per year. 30 lines resistant to soil borne diseases distributed • Genetic stocks (1,500) phenotyped for stress related traits (drought, physiological traits, zinc efficiency, disease resistance) by CIMMYT and partners.		Use by partners and stakeholders that lead to increased productivity and sustainability Wheat genetic stocks, mostly with introgressions from wild wheat relatives in improved backgrounds, evaluated for drought relevant traits	Rainfed wheat producers benefit from an increased and more stable production in particular in years with severe water stress Broadened access to genetic stocks of wheat; common platform for sharing stocks and derived phenotypic and genotypic data New genetic sources utilized globally for wheat improvement and research
Output Target 2006 • Genetically stable wheat stocks (1,500) in adapted background provided by partners and CIMMYT multiplied for screening for stress relevant traits.		Sharing and collaborative evaluation of privately developed genetic stocks	Global utilization in wheat research
Output Target 2007 • Iranian and Mexican landraces showing adaptation to extreme abiotic stress (drought, heat) are characterized for physiological traits.		Wheat cultivars with improved drought tolerance based on novel gene combinations	Reduced risk and vulnerability for farmers in marginal areas through better varieties with greater yield stability in years with severe stress
Output Target 2008 • Molecular markers identified for canopy temperature depression (CTD) and stem carbohydrates (with CSIRO)		Increased efficiency to select for drought tolerance associated traits	
Output 3. Resource conserving rainfed wheat systems: Appropriate conservation agriculture (CA) technologies and implements for more sustainable wheat-based production systems in the target area developed, evaluated and extended.	Farmers, communities, NARS, IARCs, implement manufacturers	Increased profitability and sustainability of wheat-based cropping systems; reduced water and wind erosion of soil	Farmers benefit from increased profitability, the global community benefits from more sustainable land management and carbon sequestration
Output Target 2006 • Initial options for CA under different seasonal conditions defined. Problems encountered by farmer-adopters of CA evaluated.		More flexible and cheaper options for weed control in CA conditions available	Principles affecting tailored adoption of Conservation Agriculture (CA) practices
Output Target 2007 • Options to resolve problems encountered by CA adopters developed. CA implements and practices tested, refined in 10 RFWS affected countries. Locally produced CA implements (7) countries). Long-term rotation trials maintained (2) and monitored for sustainability.		NARS research better oriented towards overcoming CA adoption problems	Networks of partners working to develop and promote conservation agriculture

Outputs	Intended user	Outcome	Impact
Output Target 2008 • Technology development specific to end-user demands and preferences (examples, 15+). On-farm promotion (50+) of CA technologies and in areas affected by salinity. Two case studies on CA conducted		Increased adoption of CA by farmers with better knowledge of the system	NARS researchers develop flexible recommendations for CA management. Greater adoption of CA by farmers
Output 4. Molecular and information technology tools for more efficient wheat breeding: Higher-throughput, lower cost, marker assisted selection (MAS), and double haploid generation advancement facilities. Information technology database connectivity and web enabled access	NARS, IARCs, ARIs	Appropriate tools to increase the research efficiency of CIMMYT and NARS partners	Better wheat cultivars developed faster to be used by farmers. Cost savings from increased selection efficiency
Annual Output Targets 2006 – 2008 • DNA extraction procedures and marker applied selection optimized to run at least 35,000 assays.		Lower cost assay systems for MAS applications	
Output Target 2007 • Options for regional MAS and double haploid laboratory facilities assessed		Increased efficiency of regional collaborative winter and spring wheat breeding efforts	Enhanced regional partner collaboration
Output Targets 2008 • International Adaptation Trial published (4+). Regional/national IWIN and GIS studies (2+). Wheat-based production environments re-classified (2+). Document (4) frequency/distribution, biology and economic losses due to root diseases in Turkey, Iran • International Crop Information System migration and application linking the disperse regional locations, and NARS associated with RFWS		Characterization of wheat rainfed production systems limitations and development of strategies to reduce constraints Increased access, use and retention of data as a global public good	Better focused, more efficient research and technology development by understanding significant points of intervention More effective technology and information transfer among and between partners
Output 5. Constraints to Technology Adoption: Investigate technology use, constraints to use, factors influencing adoption, implications for income and gender equity, resource conservation, and anticipated future research priorities	NARS, IARC	Understanding of local sustainable farm-household management	Increased effectiveness of partner and CIMMYT research, addressing the needs and constraints of RFWS farmers
Annual Output Targets 2006 – 2007 • Farm-level survey (1 country) to collect primary data for household decision-making behavior. Identify obstacles to adoption of technologies. Estimate and understand the impacts of technology adoption on livelihoods			

Outputs	Intended user	Outcome	Impact
• Adoption constraints will be better understood and documented (2) with research priorities oriented towards partner/client needs			
Output 6: Training and capacity building	NARS	Increased research effectiveness with CIMMYT's partners; better utilization of NARS bred wheat lines in neighboring countries; pre-emptive disease screening for new diseases and virulences	Strengthened capacity to improve livelihoods of resource-poor who depend on rainfed wheat systems
Annual Output Targets 2006 – 2008 • Regional and HQ based training courses in breeding, pathology, quality, physiology, and conservation agriculture (at least 50 NARS scientists trained per year) • Visiting scientists, BSc, MSc and PhD students • Support and organize 3 regional networks on testing of NARS-developed wheat lines (Caucasus, high latitude wheat, Eurasian winter wheat trial) and one network on soil-borne diseases			

Program 5: Tropical Ecosystems

Outputs	Intended user	Outcome	Impact
Output 1. Stress tolerant maize germplasm for tropical environments	Farmers, NARS, NGO's	Enhanced productivity, stability and profitability of maize farming systems	Improved food security and livelihoods of maize farmers
Annual Output Targets 2006-2008 • Biotic and abiotic stress tolerant experimental germplasm developed, and results of international trials of promising germplasm summarized and distributed **Output Targets 2006** • Callose staining method implemented in the laboratory and validated in the field for use as a rapid screening method to select for aluminum tolerance • Technical and economic assessment of maize-soybean and Cannavalia rotation for sustainable management of acid soils in Colombia • Results of drought tolerant germplasm evaluation in at least 3 countries summarized and disseminated		Promising germplasm identified for future research and testing; elite germplasm available for use by researchers and evaluation by farmers Rapid and inexpensive screening method verified, with potential important implications for acid soil tolerance breeding efficiency Promising options for integrating improved germplasm and agronomic management to enhance productivity of acid soils identified	
Output Targets 2007 • Mapping populations phenotyped and genotyped, and feasibility of marker-assisted selection to facilitate breeding for tolerance to acid soils assessed • Promising, drought tolerant germplasm identified in at least 3 countries		Enhanced efficiency of germplasm improvement efforts for acid soil areas	
Output Targets 2008 • Use of improved maize genotypes in highlands of Mexico increased from 10% to 25%		Greater productivity and/or stability of production of maize in highland areas	
Output 2. Maize with enhanced grain quality	Farmers, NARS, NGOs, maize consumers	Enhanced productivity and value of maize, and contribution to improved nutritional status and/or improved profitability of animal production.	Improved food security and livelihoods of maize farmers; improved nutritional status of some populations of maize consumers.
Annual Output Targets 2006-2008 • New QPM germplasm developed; trials of promising materials summarized and widely distributed **Output Targets 2006** • HPLC protocol for quantifying concentrations of _-carotene and other carotenoids operational at CIMMYT • Variation estimated for _-carotene concentration among BC1S1 lines for 2 African OPVs and 10 biparental populations • At least 200 elite highland-adapted and insect resistant		Increased research efficiency New genetic information will guide expectations from	

Outputs	Intended user	Outcome	Impact
germplasm screened for provitamins A concentration • At least 15 new crosses formed between elite lines and sources of high _-carotene concentration • Two carotenoid mapping populations evaluated		breeding work and assist in defining strategies for increasing _-carotene concentration New high _-carotene breeding germplasm	
Output Targets 2007 • Two generations of intra-population improvement for provitamins A completed for 2 popular African OPVs • Concentration of _-carotene and other carotenoids will be evaluated for at least 20 testcross hybrids grown at 2 or more sites • Assessment of combining ability among best new high _-carotene lines, and prediction of promising new hybrids and OPVs.		Development of _-carotene enriched versions of popular African OPVs advanced. Enhanced understanding of importance of genotype x environment interaction effects for _-carotene concentration	
Output Targets 2008 • _-carotene enriched versions of 2 popular African OPVs formed • Experimental _-carotene enriched hybrids will be included in international trials for evaluation in 2009 • Yellow QPM hybrid with enhanced _-carotene concentration available for testing • Improved (E. turcicum resistant) version of popular QPM OPV 'Aychasara' available for farmer evaluation in southern Ecuador		Two enhanced _-carotene African OPVs ready for verification with farmers after seed increase. Suitability of enhanced _-carotene hybrids ready for evaluation in several target environments. New high _-carotene breeding populations ready for further breeding work.	
Output 3. Networking and partnership building	Farmers, NARS, NGOs	Enhanced effectiveness of CIMMYT and partners	Improved food security and livelihoods of maize farmers
Output Targets 2006 • Established network (including Asia and Latin America) for acid soil tolerant germplasm development and evaluation; drought screening facilities active in at least 3 countries • Participants from at least 4 Asian countries trained in farmer-participatory variety/technology evaluation methods • Farmer-participatory evaluation of QPM hybrids and OPVs conducted in at least 4 countries (El Salvador, Honduras, Guatemala, Nicaragua and México) • QPM validation plots grown at 400 sites in El Salvador, Guatemala, Nicaragua and México • Collaborative, regional breeding projects initiated, involving at least 3 countries		Researchers in target countries able to develop and evaluate drought tolerance of maize germplasm Project partners ready to initiate farmer-participatory variety evaluations Feedback from farmers will inform future research activities "Best bet" QPM experimental varieties identified in several countries Novel technology dissemination methodology experimented / evaluated by and with farmers	

Outputs	Intended user	Outcome	Impact
Output Targets 2007 • Training and extension of callose staining method for acid soil tolerance breeding work in 2 countries • Farmer-participatory evaluation of promising, drought tolerant varieties in at least 2 Asian countries • Seed of drought tolerant varieties produced for plantings in at least 2 countries • One new QPM hybrid released in at least 2 countries (El Salvador and Nicaragua) and seed production by the private sector initiated • Farmer-participatory evaluation of promising QPM varieties in at least 6 countries in Latin America • Schools providing QPM maize to children in 2 countries (El Salvador and Guatemala) • Stress tolerance, productivity and farmer preferences assessed for local varieties improved by farmer-participatory allele introgression methods in Mexico		Farmer preferences and likely acceptance/adoption of drought tolerant germplasm assessed Options for seed provision in drought prone areas explored Growing number of QPM varieties will be available to farmers QPM contribution to child nutrition increased Suitability assessed for novel approaches to develop improved germplasm for traditional highland farming areas	
Output Targets 2008 • Promising acid soil tolerant varieties available for farmer-participatory evaluations in at least 2 countries • Farmer-participatory evaluation of crop rotation options for acid soil management in at least 2 countries • Farmer-participatory evaluation of promising, drought tolerant varieties in at least 3 countries • One QPM OPV released and available to farmers in marginal regions of each of 2 countries • One QPM hybrid released in 2 countries and seed production by the private sector initiated • "Basic" seed production unit(s) established in Central America with emphasis on QPM cultivars and QPM quality control		Extensive, farmer assessment of new germplasm and management options for acid soils Role of farmer-participatory evaluation in increasing relevance and adoption of researcher-generated technologies recognized Availability of and farmers' access to seed of QPM varieties enhanced	

Program 6. Intensive Agro-ecosystems

Outputs	Intended user	Outcome	Impact
Output 1. New maize and wheat production technologies that facilitate diversification developed and adopted	Farmers, particularly the rural poor in maize- and wheat- intensive agro-ecosystems	Increase incomes and reduce poverty by expanding employment in rural areas via expanded high-value, labor-intensive crop and livestock activities in maize and wheat systems	Employment for the landless poor and higher incomes for farm families through diversification
Annual Output Targets 2006-2008 • Bread, durum and winter wheat international nurseries for resistance, tolerance traits screened in "hot spots"	NARS, ARI breeders, farmers	Shuttle breeding on a global scale to screen improved materials in "hot spots" for diseases or other stresses	Increased efficiency of the breeding programs leading to better varieties, faster, in farmers' fields
Output Targets 2006 • Regional wheat nurseries (e.g., EGPSN and EGPYT) distributed to cooperators, analyzed and data distributed to NARS; 5-10 elite maize lines released	NARS from China, South Asia, CWANA; ARIs	Increased efficiency of national breeding programs; improved understanding of genotype by environment interaction; broadening the elite germplasm base for NARS maize breeding	Higher wheat and maize yields in farmers' fields
• End use quality of 200-300 advanced wheat lines with high yield potential and earliness screened	CGIAR center, ARI and NARS researchers	New genetic material incorporated into breeding materials	More tasty and healthy food reaching rural and urban consumers
• Maintenance of existing conservation agriculture field station trials in Mexico	NARS agronomists, trainees	Increased knowledge of long-term agronomic and environmental consequences of CA technologies for maize and wheat systems	Improved farmers' income, and soil health and water productivity due to new conservation agriculture technology
Output Targets 2007 • At least two proposals for studying the effects of conservation agriculture on soil and environmental quality submitted	NARS scientists, farmers and other IARCs	Farmers shifting from excessive tillage to conservation agriculture; robust technologies become available	Improve farmers' income, and soil health and water productivity through conservation agriculture
• Livelihood implications of resource conserving technologies (RCTs) in Indo-Gangetic Plains of South Asia understood and documented	Policy makers	Information to inform the decision-making process regarding policies and institutions that support RCTs produced and shared with policymakers	
Output 2. Production technologies and supporting policies for stressed environments	Urban and rural consumers, particularly the poor	Improve food security and reduce vulnerability for poor consumers	Food security for poor consumers
Output Targets 2006 • Global stem rust initiative fully functional	Wheat pathologists and breeders	Monitoring the spread of a new highly virulent stem rust race from Africa to other areas and testing of germplasm to identify diverse sources of resistance	NARS implement proper control strategies and provide resistant germplasm for wheat breeding that will translate into stable high wheat yields worldwide
• Resistance-related genes for *fusarium* head blight (scab) in wheat identified and linked DNA markers developed	NARS	Knowledge sharing through articles in international and national refereed journals	Farmers benefit through increased wheat productivity

Outputs	Intended user	Outcome	Impact
• Segregating and early-advanced wheat screened for quality traits and other wheat and triticale for feed and forage quality traits (protein content, energy value)	CGIAR centers, ARI and NARS researchers	New genetic material incorporated into breeding materials	More tasty and healthy food reaching rural and urban consumers
Output Targets 2007 • Resistance genes that confer race-specific and durable resistance to three wheat rust diseases identified	Wheat pathologists and breeders	Diversity of resistance to rust diseases in wheat increased	Secured food production
• International tan spot (wheat) initiative stimulated through a new network of partners	Wheat pathologists, breeders and agronomists	Adoption of conservation agriculture more sustainable for farm communities	Cost of wheat production reduced and resource conservation increased
Output Targets 2008 • Trap nursery efforts on wheat rusts better coordinated through information exchange at regional level	Wheat pathologists and breeders	Early warning system in place to protect farmers' production	Timely replacement of cultivars to secure food production
• Seed production systems for QPM hybrids and synthetics in South Asia identified and established	Small scale seed producers, farmers cooperatives	A sustainable and affordable seed production system for producing QPM in rural areas of South Asia	Enhanced food and nutritional security
• Synergies and tradeoffs of conservation agriculture, livestock and livelihood strategies in the Indo-Gangetic Plains of South Asia understood and documented	Policy makers	Information regarding policies and institutions that affect the use of conservation agriculture in crop-livestock systems produced and shared with policymakers	Social science and policy support for sustainable food security
Output 3. Resource conserving technologies (RCTs) for maize and wheat systems that improve water productivity and soil health; information for policymakers regarding water use and water productivity in agriculture	Civil society users	Reduced water consumption in agriculture; more available for alternative uses (urban, industrial, ecological and environmental). In addition, foster improved soil health and avoid land degradation	Conserving resources
Annual Output Targets 2006-2008 • 100 elite water use efficient bread wheat lines and 100 segregating materials deployed in international nurseries	NARS, ARI breeders	Water-use-efficient wheat cultivars adopted by farmers in the intensive agro-ecosystems of the developing world	Improved productivity in wheat improves livelihoods of poor farmers
• Winter and facultative wheat with good quality and resistance to abiotic and biotic stresses in irrigated environments developed and tested with NARS	NARS		
• End use quality of 200-300 advanced wheat lines with high yield potential and water use efficiency screened	CGIAR centers, ARI and NARS researchers	New genetic material incorporated into breeding materials	More tasty and healthy food reaches rural and urban consumers

Outputs	Intended user	Outcome	Impact
Output Targets 2006 • 100 elite bread wheat lines characterized for water-use efficiency	Breeders at CIMMYT and NARS, farmers experiencing decline in water availability	Breeders gain knowledge of water-use efficiency of germplasm and farmers adopt cultivars with better water-use efficiency	Increased bread wheat production per unit water applied to farmers fields in intensive agro-ecosystem target areas
• Appropriate conservation agriculture technologies and implements for non-rice based irrigated production systems developed and promoted	NARS, farmers	*Cost of producing rice and wheat and other crops reduced*	Farmers' incomes increased; sustainable rice-wheat cropping systems
• On farm impacts of zero-tillage in Haryana, India and Punjab, Pakistan understood and documented	Policy makers	Market, policy analysis of factors governing adoption of water use efficient crops and practices	More water available for alternative uses (urban, industrial, environmental)
Output Targets 2008 • Bed-planting technology of wheat production in cotton-wheat irrigated systems in 15 regions of 3 Central Asian countries accepted • Effects of conservation agriculture practices on system productivity, water use efficiency, soil degradation and erosion quantified; technologies developed for farmers in rainfed areas in China	Central Asian small private farmers, cooperatives, grain companies Farmers, environmentalists, provincial governments in target areas	Reduced water erosion, reduced use of water, increased stability of grain production Appropriate conservation agriculture systems for smallholder farmers that improve agro-ecosystem productivity adapted	Improved profitability of grain production and improvement of rural livelihoods plus better soil fertility Agro-ecosystem productivity enhanced and soil and water resources conserved
Output 4. Training and human resources in research-for-development (including technology targeting and priority setting) strengthened	Partners in research-for-development throughout intensive maize and wheat agro-ecosystems	Strengthened capacity of partners to conduct research for intensification and diversification of maize and wheat systems	NARS capacity strengthened
Annual Output Targets 2006-2008 • Rice-Wheat Consortium (RWC) activities- meetings, publications and web services organized as per schedules.	NARS, CGIAR centres	*RWC remains viable to serve its partners and stakeholders*	Knowledge and technology reaches end-users in the Indo-Gangetic Plains; food production sustained and incomes enhanced
Output Target 2007 • Participatory maize and wheat varietal selection (PVS) initiative through a wide network of partners stimulated	Farmers, scientists, extensionists, seed producers, machinery manufacturers	Enhanced adoption by farmers of new technologies (improved maize and wheat cultivars and resource conservation techniques)	Increased production and improved livelihoods of resource-poor farmers. Cost of wheat production reduced and resource conservation increased
Output Target 2008 • Seed systems and technology exchange efforts better coordinated at regional level	Farmers, policy makers, scientists, extensionists, seed producers, machinery manufacturers	Enhanced adoption of new wheat and maize production technologies	Improved livelihoods of resource-poor farmers. Reduced risk of large scale disease epidemics securing food production

Ecoregional Program: Improved Livelihoods and Sustainability of Rice Wheat Systems of the Indo-Gangetic Plains (IGP)

Outputs	Intended User	Outcome	Impact
Output 1 Technologies and policies for improved water productivity, soil health and enhanced diversity of the rice-wheat systems developed • Cultivar choices in new rotations identified, expanded legume area through use of bed planting systems and improve water productivity	Farmers in South Asia		Alternate sources of productivity growth in IGP increased and rice-wheat systems diversified.
Output Target 2006 • Multi-crop zero-till seed drills / bed planter developed, tested and refined for seeding into loose residues	NARS, CGIAR centers and farmers	Different prototypes of the multi-crop seed drills manufactured across the region by private entrepreneurs. Timely planting increases cropping intensity in low-land rice systems.	Livelihoods of farmers in rainfed eastern IGP improved, burning of crop residues reduced and fodder crops grown in systems to improve their availability for livestock.
Output Target 2007 • QPM maize, short duration pigeon pea, mungbean and dual purpose wheat introduced to IGP and direct seeded rice practices developed for double no-till systems	CGIAR centers , NARS and farmers in IGP	Quality seed (e.g., QPM maize, pigeon pea, lentil, mungbean etc.) produced locally by farmers.	Produce more at less cost, reduce fodder scarcity for livestock, improved nutrition through QPM maize and pulses. Increased seed replacement rates .Practice of complete burning of residues replaced by partially retaining them
Output Target 2008 • New drills for seeding into loose residue placed in the hands of the farmers to experiment extensively. Co-culturing of rice and other crops with green manure crops is developed.	CGIAR centers ,NARS farmers	Capital investment increases. Greater involvement of private manufacturers, input dealers and service providers.	Burning of residues reduced and practice of green manuring becomes popular for improved soil health and environmental quality
Output 2: Accelerated adoption of resource conserving technologies in the Indo-Gangetic Plains • Different layers of RCTs super-imposed (laser land leveling, zero till , surface seeding, bed planting and para-cropping, N management, paired row planting and controlled traffic and residue management) adopted by farmers in the IGP	NARS and farmers in South Asia	Farmers using yield maximization practices to save on water and other inputs and improved soil health and environmental quality.	Sustainability of the rice-wheat system improves.

Outputs	Intended User	Outcome	Impact
Output Target 2006 • New RCT practices developed and popularized amongst the farmers	NARS and farmers in South Asia		Cost of producing rice and wheat and other corps reduced to improve farmer incomes.
Output targets 2007 • Congress on conservation agriculture organized to share and exchange information in South Asia.	NARS, CGIAR centres and farmer associations	Information on RCTs is collated and exchanged to promote conservation agriculture	Visibility of the national efforts for promoting RCTs improves globally.
Output targets 2008 • Contract hiring of new RCTs becomes popular in IGP	NARS, farmers	Machines become accessible to land less and small and marginal rental farmers	More area covered under RCTs and additional employment generated
Output 3. Strengthened capacity of partners to conduct research for sustainable intensification and diversification of rice wheat systems and make RCT information available to users • Researchers and extensionists trained in new RCTs practices for backstopping. National scientists trained in targeting RCTs appropriately according to location specificity	NARS and Farmers		
Output Target 2006 • RWC activities- meetings, publications and web services activities organized as per scheduled.	NARS, CGIAR	More skilled human capacity becomes available for new RCTs	National partners include the RCTs in their regular programs
Output Target 2007 • GIS, remote sensing techniques and socioeconomic techniques tested for targeting the RCTs in different rice ecologies in IGP.	NARS, CGIAR	More skilled human capacity becomes available on new technologies	In NARS local plans are based on the new databases to enhance productivity in site specific domains

RCT: Resource conserving technology

CIMMYT - Allocation of Projects Cost to CGIAR OutPuts, 2006

in $ millions

Center Projects	Germplas Inprovement	Germplas Collection	Sustainable Production	Policy	Enhancing NARS	Total
Program 1: Genetic Resources	2.235	3.910	0.000	0.000	0.838	6.983
Program 2: Impacts Targeting and Assessment	0.000	0.000	0.000	1.713	0.633	2.346
Program 3: African Livelihoods	3.472	0.772	2.894	0.965	1.542	9.645
Program 4: Rainfed Wheat Systems	1.278	0.664	2.759	0.000	0.409	5.110
Program 5: Tropical Ecosystems Program	1.786	0.804	0.670	0.000	1.204	4.464
Program 6: Intensive Agroecosystems	2.280	1.425	2.565	0.000	0.855	7.125
RWC: Rice Wheat Consortium for the Indo-Gangetic Plains	0.107	0.000	0.546	0.356	0.178	1.187
Total	11.158	7.575	9.434	3.034	5.659	36.860

CIMMYT - Cost Allocation: Allocation of Resources by Projects, 2004-2008

in $ millions

Project	Actual 2004	Estimated 2005	Proposal 2006	Plan 1 2007	Plan 2 2008
Program 1: Genetic Resources	7.856	7.745	6.983	7.192	7.408
Program 2: Impacts Targeting and Assessment	1.966	2.949	2.346	2.418	2.490
Program 3: African Livelihoods	9.837	10.099	9.645	9.933	10.231
Program 4: Rainfed Wheat Systems	5.358	4.677	5.110	5.263	5.421
Program 5: Tropical Ecosystems Program	4.806	4.721	4.464	4.598	4.736
Program 6: Intensive Agroecosystems	8.895	7.512	7.125	7.339	7.559
RWC: Rice Wheat Consortium for the Indo-Gangetic Plains	1.380	1.380	1.187	1.223	1.260
Total	40.098	39.083	36.860	37.966	39.105

CIMMYT - Cost Allocation: Allocation of Resources by CGIAR Outputs, 2004-2008

in $ millions

Outputs	Actual 2004	Estimated 2005	Proposal 2006	Plan 1 2007	Plan 2 2008
Germplasm Improvement	12.287	11.699	11.158	11.490	11.836
Germplasm Collection	8.527	8.105	7.575	7.803	8.035
Sustainable Production	10.402	9.603	9.434	9.717	10.007
Policy	2.833	3.577	3.034	3.125	3.219
Enhancing NARS	6.049	6.099	5.659	5.831	6.008
Total	40.098	39.083	36.860	37.966	39.105

CIMMYT - Cost Allocation: Allocation of Project Cost to CGIAR Outputs, 2004-2008

in $ millions

Projects / Outputs	Actual 2004	Estimated 2005	Proposal 2006	Plan 1 2007	Plan 2 2008
Program 1: Genetic Resources					
Germplasm Improvement	2.514	2.478	2.235	2.301	2.371
Germplasm Collection	4.399	4.337	3.910	4.028	4.148
Enhancing NARS	0.943	0.930	0.838	0.863	0.889
Total Project	7.856	7.745	6.983	7.192	7.408
Program 2: Impacts Targeting and Assessment					
Policy	1.435	2.153	1.713	1.765	1.818
Enhancing NARS	0.531	0.796	0.633	0.653	0.672
Total Project	1.966	2.949	2.346	2.418	2.490
Program 3: African Livelihoods					
Germplasm Improvement	3.541	3.636	3.472	3.576	3.683
Germplasm Collection	0.787	0.808	0.772	0.795	0.818
Sustainable Production	2.951	3.030	2.894	2.980	3.069
Policy	0.984	1.010	0.965	0.993	1.023
Enhancing NARS	1.574	1.615	1.542	1.589	1.638
Total Project	9.837	10.099	9.645	9.933	10.231
Program 4: Rainfed Wheat Systems					
Germplasm Improvement	1.340	1.169	1.278	1.316	1.355
Germplasm Collection	0.697	0.608	0.664	0.684	0.705
Sustainable Production	2.893	2.526	2.759	2.842	2.927
Enhancing NARS	0.428	0.374	0.409	0.421	0.434
Total Project	5.358	4.677	5.110	5.263	5.421
Program 5: Tropical Ecosystems Program					
Germplasm Improvement	1.922	1.888	1.786	1.839	1.895
Germplasm Collection	0.865	0.850	0.804	0.828	0.852
Sustainable Production	0.721	0.708	0.670	0.690	0.710

Projects Outputs	Actual 2004	Estimated 2005	Proposal 2006	Plan 1 2007	Plan 2 2008
Enhancing NARS	1.298	1.275	1.204	1.241	1.279
Total Project	4.806	4.721	4.464	4.598	4.736
Program 6: Intensive Agroecosystems					
Germplasm Improvement	2.846	2.404	2.280	2.348	2.419
Germplasm Collection	1.779	1.502	1.425	1.468	1.512
Sustainable Production	3.202	2.704	2.565	2.642	2.721
Enhancing NARS	1.068	0.902	0.855	0.881	0.907
Total Project	8.895	7.512	7.125	7.339	7.559
RWC: Rice Wheat Consortium for the Indo-Gangetic Plains					
Germplasm Improvement	0.124	0.124	0.107	0.110	0.113
Sustainable Production	0.635	0.635	0.546	0.563	0.580
Policy	0.414	0.414	0.356	0.367	0.378
Enhancing NARS	0.207	0.207	0.178	0.183	0.189
Total Project	1.380	1.380	1.187	1.223	1.260
Total	40.098	39.083	36.860	37.966	39.105

CIMMYT - Investments by Sector and Commodities, 2004-2008

in $ millions

Sector	Commodity	Actual 2004	Estimated 2005	Proposal 2006	Plan 1 2007	Plan 2 2008
Crops	Maize	22.054	21.495	20.273	20.881	21.508
	Wheat	18.044	17.588	16.587	17.085	17.597
	Total	40.098	39.083	36.860	37.966	39.105

CIMMYT - Allocation of Projects Cost to CGIAR Regions, 2006
in $ millions

Project	Region	Actual 2004	Estimated 2005	Proposal 2006	Plan1 2007	Plan2 2008
Program 1: Genetic Resources	Asia	1.964	1.936	1.746	1.798	1.852
	CWANA	1.571	1.549	1.397	1.439	1.481
	LAC	1.571	1.549	1.396	1.438	1.482
	SSA	2.750	2.711	2.444	2.517	2.593
	Total Project	7.856	7.745	6.983	7.192	7.408
Program 2: Impacts Targeting and Assessment	Asia	0.492	0.737	0.586	0.604	0.622
	CWANA	0.492	0.737	0.587	0.605	0.623
	LAC	0.491	0.738	0.586	0.604	0.622
	SSA	0.491	0.737	0.587	0.605	0.623
	Total Project	1.966	2.949	2.346	2.418	2.490
Program 3: African Livelihoods	SSA	9.837	10.099	9.645	9.933	10.231
	Total Project	9.837	10.099	9.645	9.933	10.231
Program 4: Rainfed Wheat Systems	Asia	1.607	1.403	1.533	1.579	1.626
	CWANA	3.215	2.806	3.066	3.158	3.253
	LAC	0.536	0.468	0.511	0.526	0.542
	Total Project	5.358	4.677	5.110	5.263	5.421
Program 5: Tropical Ecosystems Program	Asia	2.403	2.361	2.232	2.299	2.368
	LAC	2.403	2.360	2.232	2.299	2.368
	Total Project	4.806	4.721	4.464	4.598	4.736
Program 6: Intensive Agroecosystems	Asia	4.448	3.756	3.563	3.670	3.780
	LAC	4.447	3.756	3.562	3.669	3.779
	Total Project	8.895	7.512	7.125	7.339	7.559
RWC: Rice Wheat Consortium for the Indo-Gangetic Plains	Asia	1.380	1.380	1.187	1.223	1.260
	Total Project	1.380	1.380	1.187	1.223	1.260
	Total	40.098	39.083	36.860	37.966	39.105

Summary by Region, 2004-2008

Region	Actual 2004	Estimated 2005	Proposal 2006	Plan1 2007	Plan2 2008
SSA	13.078	13.547	12.676	13.055	13.447
Asia	12.294	11.573	10.847	11.173	11.508
LAC	9.448	8.871	8.287	8.536	8.793
CWANA	5.278	5.092	5.050	5.202	5.357
Total	40.098	39.083	36.860	37.966	39.105

CIMMYT - Expenditures by Object, 2004-2008

in $ millions

Object of Expenditure	Actual 2004	Estimated 2005	Proposal 2006	Plan 1 2007	Plan 2 2008
Personnel	16.870	17.583	17.610	18.138	18.682
Supplies and Services	13.531	13.250	11.900	12.257	12.625
Collaboration/Partnerships	5.742	5.400	4.800	4.944	5.092
Operational Travel	1.858	1.600	1.300	1.339	1.379
Depreciation	2.097	1.250	1.250	1.288	1.327
Total	40.098	39.083	36.860	37.966	39.105

CIMMYT - Members and Non-Members Unrestricted and Restricted Grants, 2004-2006

in $ millions

Member	Actual 2004	Estimated 2005	Proposal 2006
Unrestricted Contributions			
Member			
Australia	0.454	0.506	0.542
Belgium	0.204	0.104	0.000
Canada	1.798	1.141	1.141
China	0.140	0.150	0.150
Denmark	0.463	0.461	0.461
France	0.000	0.144	0.144
Germany	0.309	0.150	0.150
India	0.113	0.113	0.123
Japan	1.503	1.190	1.190
Korea	0.050	0.050	0.050
Mexico	0.025	0.025	0.025
Netherlands	0.000	0.792	0.792
New Zealand	0.050	0.050	0.000
Norway	0.294	0.294	0.294
Peru	0.010	0.060	0.060
Philippines	0.007	0.007	0.007
Sweden	0.385	0.385	0.385
Switzerland	0.312	0.491	0.491
Thailand	0.021	0.011	0.011
United Kingdom	1.540	1.502	1.502
United States	4.232	3.957	3.957
World Bank	1.800	1.700	1.700
Sub total	13.710	13.283	13.175

Member	Actual 2004	Estimated 2005	Proposal 2006
Sub total	13.710	13.283	13.175

Restricted Contributions

Member			
ADB	0.284	0.339	0.250
Australia	2.117	1.583	1.559
Belgium	0.448	0.205	0.000
Canada	0.933	1.235	1.056
China	0.300	0.000	0.000
Colombia	0.105	0.135	0.135
Denmark	0.069	0.097	0.000
European Commission	3.072	2.581	2.254
FAO	0.030	0.020	0.020
France	0.569	0.015	0.015
Germany	0.946	0.912	0.793
IDB	0.000	0.021	0.014
IFAD	0.165	0.732	0.543
Iran	0.215	0.443	0.383
Japan	0.780	1.517	1.204
Korea	0.085	0.078	0.065
Netherlands	0.432	0.000	0.000
New Zealand	0.021	0.000	0.000
Norway	0.030	0.000	0.000
Peru	0.024	0.000	0.000
Rockefeller Foundation	2.392	1.792	1.859
South Africa	0.064	0.039	0.039
Spain	0.188	0.202	0.202
Sweden	0.017	0.008	0.000
Switzerland	0.909	1.467	1.307

Member	Actual 2004	Estimated 2005	Proposal 2006
Syngenta Foundation	0.647	0.780	0.413
United Kingdom	0.000	0.754	0.405
United States	3.424	2.805	1.883
World Bank	1.161	2.652	0.176
Sub total	19.427	20.412	14.575
Non-member			
Agrovegetal	0.063	0.080	0.106
Busch Agri Research	0.018	0.010	0.010
FENALCE	0.103	0.138	0.138
Fundacion Guanajuato Produce A.C.	0.040	0.320	0.338
Fundacion Sonora	0.194	0.007	0.000
Generation/CP	0.000	0.968	0.886
HarvestPlus/CP	0.470	0.294	0.275
ICIPE	0.050	0.022	0.022
ICRISAT	0.004	0.007	0.000
IFPRI	0.215	0.000	0.250
IWMI	0.000	0.067	0.000
Lamsoo Milling Company	0.000	0.001	0.000
Monsanto Life Science Company	0.006	0.000	0.000
Nippon Foundation	0.584	0.751	0.521
Oklahoma State Univeristy	0.003	0.000	0.000
Pioneer	0.009	0.031	0.000
Stanford University	0.076	0.010	0.050
Unidentified	2.347	0.762	4.634
Washington State University	0.178	0.088	0.100
Sub total	4.360	3.556	7.330
Sub total	23.787	23.968	21.905
Total	37.497	37.251	35.080

CIMMYT - Financing: Restricted Grants And Center Income, 2004-2004-2008
in $ millions

Project	Member		Actual 2004	Estimated 2005	Proposal 2006
Program 1: Genetic Resources	Member	ADB	0.284	0.089	0.000
		Australia	0.385	0.307	0.158
		European Commission	1.089	1.053	0.986
		France	0.410	0.015	0.015
		Japan	0.325	1.029	0.794
		Korea	0.085	0.078	0.065
		Rockefeller Foundation	0.713	0.140	0.280
		Switzerland	0.041	0.050	0.050
		United States	0.203	0.197	0.235
		World Bank	0.451	0.712	0.176
	Non Member	Generation/CP	0.000	0.960	0.878
		HarvestPlus/CP	0.021	0.005	0.005
		Unidentified	0.278	0.289	0.712
	Unrestricted + Center Income		3.571	2.821	2.629
		Project Totals	7.856	7.745	6.983
Program 2: Impacts Targeting and Assessment	Member	Denmark	0.069	0.097	0.000
		European Commission	0.202	0.687	0.620
		FAO	0.012	0.020	0.020
		France	0.014	0.000	0.000
		Germany	0.029	0.000	0.000
		IFAD	0.036	0.048	0.000
		Rockefeller Foundation	0.136	0.177	0.008
		United States	0.107	0.153	0.093
		World Bank	0.054	0.485	0.000
	Non Member	Generation/CP	0.000	0.008	0.008
		HarvestPlus/CP	0.101	0.030	0.030

Project	Member		Actual 2004	Estimated 2005	Proposal 2006
		IWMI	0.000	0.067	0.000
		Unidentified	0.168	0.024	0.500
	Unrestricted + Center Income		1.038	1.153	1.067
		Project Totals	1.966	2.949	2.346
Program 3: African Livelihoods	Member	Australia	0.234	0.000	0.000
		Canada	0.909	1.223	1.044
		European Commission	0.072	0.058	0.041
		Germany	0.765	0.748	0.517
		IFAD	0.000	0.433	0.433
		Rockefeller Foundation	1.533	1.465	1.571
		South Africa	0.037	0.013	0.013
		Switzerland	0.428	0.701	0.701
		Syngenta Foundation	0.596	0.780	0.413
		United Kingdom	0.000	0.255	0.245
		United States	0.832	0.837	0.322
		World Bank	0.284	0.000	0.000
	Non Member	HarvestPlus/CP	0.099	0.016	0.016
		ICIPE	0.050	0.022	0.022
		Nippon Foundation	0.374	0.704	0.521
		Unidentified	0.120	0.293	1.388
	Unrestricted + Center Income		3.504	2.551	2.398
		Project Totals	9.837	10.099	9.645
Program 4: Rainfed Wheat Systems	Member	Australia	1.302	0.893	1.145
		Canada	0.007	0.000	0.000
		European Commission	1.138	0.355	0.355
		FAO	0.018	0.000	0.000
		Germany	0.126	0.105	0.208
		Iran	0.215	0.443	0.383
		South Africa	0.027	0.026	0.026

Project	Member		Actual 2004	Estimated 2005	Proposal 2006
		United States	0.020	0.138	0.121
		World Bank	0.153	0.485	0.000
	Non Member	Busch Agri Research	0.018	0.010	0.010
		Fundacion Guanajuato Produce A.C.	0.018	0.008	0.000
		HarvestPlus/CP	0.009	0.000	0.000
		IFPRI	0.000	0.000	0.250
		Unidentified	0.110	0.000	0.250
		Washington State University	0.178	0.088	0.100
	Unrestricted + Center Income		2.019	2.126	2.262
		Project Totals	5.358	4.677	5.110
Program 5: Tropical Ecosystems Program	Member	ADB	0.000	0.250	0.250
		Canada	0.002	0.000	0.000
		Colombia	0.105	0.135	0.135
		European Commission	0.000	0.087	0.030
		Japan	0.167	0.254	0.215
		Peru	0.024	0.000	0.000
		Rockefeller Foundation	0.010	0.010	0.000
		Spain	0.029	0.031	0.031
		Switzerland	0.440	0.716	0.556
		Syngenta Foundation	0.051	0.000	0.000
		United States	0.005	0.060	0.060
		World Bank	0.134	0.485	0.000
	Non Member	FENALCE	0.103	0.138	0.138
		HarvestPlus/CP	0.000	0.110	0.095
		IFPRI	0.215	0.000	0.000
		Monsanto Life Science Company	0.006	0.000	0.000
		Nippon Foundation	0.175	0.017	0.000
		Unidentified	0.452	0.000	0.500
	Unrestricted + Center Income		2.888	2.428	2.454

Project	Member		Actual 2004	Estimated 2005	Proposal 2006
		Project Totals	4.806	4.721	4.464
Program 6: Intensive Agroecosystems	Member	Australia	0.196	0.383	0.256
		Belgium	0.448	0.205	0.000
		Canada	0.015	0.012	0.012
		China	0.300	0.000	0.000
		European Commission	0.556	0.148	0.148
		France	0.145	0.000	0.000
		Germany	0.026	0.059	0.068
		IDB	0.000	0.021	0.014
		IFAD	0.129	0.251	0.110
		Japan	0.288	0.234	0.195
		New Zealand	0.021	0.000	0.000
		Norway	0.030	0.000	0.000
		Spain	0.159	0.171	0.171
		Sweden	0.017	0.008	0.000
		United Kingdom	0.000	0.371	0.032
		United States	1.701	0.997	0.552
		World Bank	0.085	0.485	0.000
	Non Member	Agrovegetal	0.063	0.080	0.106
		Fundacion Guanajuato Produce A.C.	0.022	0.312	0.338
		Fundacion Sonora	0.194	0.007	0.000
		HarvestPlus/CP	0.240	0.133	0.129
		ICRISAT	0.004	0.007	0.000
		Lamsoo Milling Company	0.000	0.001	0.000
		Nippon Foundation	0.035	0.030	0.000
		Oklahoma State Univeristy	0.003	0.000	0.000
		Pioneer	0.009	0.031	0.000
		Stanford University	0.076	0.010	0.050
		Unidentified	0.971	0.075	1.274

Project	Member		Actual 2004	Estimated 2005	Proposal 2006
	Unrestricted + Center Income		3.162	3.481	3.670
		Project Totals	8.895	7.512	7.125
RWC: Rice Wheat Consortium for the Indo-Gangetic Plains	Member	European Commission	0.015	0.193	0.074
		Netherlands	0.432	0.000	0.000
		United Kingdom	0.000	0.128	0.128
		United States	0.556	0.423	0.500
	Non Member	Unidentified	0.248	0.081	0.010
	Unrestricted + Center Income		0.129	0.555	0.475
		Project Totals	1.380	1.380	1.187
		Total	40.098	39.083	36.860

CIMMYT - Internationally and Nationally Recruited Staff, 2004-2008

Staff	Actual 2004	Estimated 2005	Proposal 2006	Plan 1 2007	Plan 2 2008
NRS	653	656	656	656	656
IRS	95	90	97	97	97
Total	748	746	753	753	753

CIMMYT - Currency Structure of Expenditures, 2004-2006

in $ millions

	Actual 2004			Estimated 2005			Proposal 2006		
Currency	Amount	$ Value	% Share	Amount	$ Value	% Share	Amount	$ Value	% Share
AUD	2.905	1.885	5	2.891	2.089	5	2.878	2.101	6
CAD	3.218	2.421	6	3.040	2.376	6	2.702	2.197	6
CHF	1.763	1.375	3	2.391	1.958	5	2.194	1.798	5
COP	0.309	0.110	0	0.605	0.245	1	0.564	0.230	1
DKK	3.347	0.554	1	2.800	0.461	1	2.800	0.483	1
EUR	4.359	5.303	13	4.461	5.355	14	3.766	4.669	13
GBP	1.228	2.201	5	1.293	2.256	6	1.060	1.907	5
JPY	196.988	1.876	5	303.184	2.707	7	251.370	2.394	6
NOK	2.121	0.312	1	2.000	0.294	1	0.000	0.295	1
Others	0.000	0.025	0	0.000	0.114	0	0.000	0.084	0
SEK	3.086	0.440	1	3.565	0.490	1	2.745	0.385	1
USD	23.596	23.596	59	20.738	20.738	53	20.317	20.317	55
Total		40.098	100 %		39.083	100 %		36.860	100 %

CIMMYT - Statements of Activities for the years ended December 31, 2004 and 2003

in $ millions

Statements		Unrestricted	Restricted		Total	
			Temporary	Challenge Programs	2004	2003
Revenue and Gains	Grant Revenue	13.710	22.624	1.066	37.400	35.785
	Other revenue and gains	4.098	0.000	0.000	4.098	5.136
Expenses and Losses	Program related expenses	9.840	21.059	1.066	31.965	29.292
	Management and general expenses	5.706	1.565	0.000	7.271	9.561
	Other losses expenses	0.862	0.000	0.000	0.862	1.346
	Indirect cost recovery	0.000	0.000	0.000	0.000	0.000
	Extraordinary Items	0.000	0.000	0.000	0.000	0.000
Object of Expenditures	Personnel	9.093	7.425	0.352	16.870	18.003
	Supplies and Services	5.034	8.115	0.382	13.531	13.449
	Collaboration/Partnerships	0.126	5.363	0.253	5.742	4.652
	Operational Travel	0.850	0.963	0.045	1.858	1.199
	Depreciation	1.305	0.758	0.034	2.097	2.896
	Total	16.408	22.624	1.066	40.098	40.199

CIMMYT - Statements of Financial Position at December 31, 2004 and 2003
in $ millions

Assets, Liabilities and Net Assets	2004	2003
Current Assets		
Cash and cash equivalents	5.619	7.426
Investments	8.500	0.000
Accounts receivable		
- Donor	6.480	9.019
- Employees	0.067	0.132
- Other CGIAR Centers	0.007	0.006
- Others	1.067	0.933
Inventories	0.109	0.129
Prepaid expenses	0.004	0.015
Total Current Assets	21.853	17.660
Non-Current Assets		
Property, Plan and Equipment	15.307	15.302
Investments	0.000	0.000
Other Assets	0.062	0.062
Total Non-Current Assets	15.369	15.364
Total Assets	37.222	33.024
Current Liabilities		
Overdraft/Short term Borrowings	0.000	3.390
Accounts payable		
- Donor	14.453	9.771
- Employees	0.046	0.079
- Other CGIAR Centers	0.000	0.000
- Others	1.364	0.189
Accruals	0.774	0.605
Total Current Liabilities	16.637	14.034
Non-Current Liabilities		
Accounts payable		
- Employees	0.000	0.000
- Deferred Grant Revenue	0.000	0.000
- Others	0.417	0.592
Total Non-Current Liabilities	0.417	0.592
Total Liabilities	17.054	14.626
Net Assets		
Unrestricted		
- Designated	15.307	15.347
- Undesignated	4.861	3.051
Total Unrestricted Net Assets	20.168	18.398
Restricted	0.000	0.000
Total Net Assets	20.168	18.398
Total Liabilities and Net Assets	37.222	33.024