

CIMMYT • ECONOMICS • PROGRAM

Briefing Book
Center-Commissioned
External Review

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18-21 June 1997
CIMMYT, Mexico



CIMMYT

Briefing Book

**CIMMYT Economics Program
Center-Commissioned External Review**

**18-21 June 1997
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1. Introduction

Recent Changes in the CIMMYT Economics Program, 1994-97

Since its 1993 review, the CIMMYT Economics Program has gone through a major transformation in its research program, staffing, linkages with other CIMMYT programs, and linkages with CIMMYT outreach programs. The Program looks forward to integrating its work within the new CIMMYT project structure that is to be implemented in 1998. We are seeking a critical assessment and an endorsement of our plans as we orient ourselves for the next decade.

Changes in research themes

During an internal review conducted in April 1996, the Economics Program identified the following research themes as areas for continued and/or enhanced involvement:

- impact assessment;
- technology design and forecasting;
- economics of genetic diversity;
- long-term demand/supply projections; and
- research priority setting.

We believe that our traditional strength in *ex post* analysis needs to be complemented with an increased effort in forward-looking, *ex ante* analysis. We also believe that the unique advantage of the Economics Program is in working at the interface between technology, policy, and the resource environment. We do not anticipate doing the work described in this briefing book in isolation, but rather seek to build partnerships with other CIMMYT programs and with economists in the NARS and in advanced country universities. Our recently initiated Economics Affiliates Program will add to our strength -- not only in numbers of staff but also in quality of research and enhanced expertise.

In the area of **impact assessment**, we have made a conscious attempt to blend work on the adoption and impact of germplasm with emerging concerns over equity, including gender equity, and over the environmental impact of modern wheat and maize farming systems. Impact assessment is a distinct project in the CIMMYT Medium Term Plan for 1998-2000+, and under this project we propose that a multidisciplinary group of scientists focus on the impact of CIMMYT's technology development. We have begun to update the global wheat and maize impact studies, first undertaken in the early 1990s. These studies were extremely well received and the demand for follow-up studies has been strong. In addition, we are initiating an assessment of spillovers of wheat and maize research in Latin America and the implications for enhancing the efficiency of the research system. We plan to make a comparative assessment of the classic Green Revolution sites across the world, such as the Indian Punjab and the Yaqui Valley, and develop a prognosis of the future productivity and sustainability of each site. Finally, the Program will initiate work in two areas which have not featured strongly in our previous work: the gender-related impacts of technical change and constraints to the adoption of crop and resource management technologies.

Our efforts in ***ex ante* technology evaluation and forecasting potential impact domains** are also relatively new, and we see substantial scope for methodology development in this area. We plan to start with some specific problems that need support from Economics and gradually work towards a more general methodology for technology forecasting. Our first effort in this area is to conduct an *ex ante* assessment of

emerging biotechnology products; in collaboration with the CIMMYT biotechnology group, we will assess the economics of apomixis and of marker-assisted selection. We will also initiate an evaluation of the technological prospects for unfavorable maize and wheat environments, with an emphasis on drought prone-maize production environments. Another study soon to be underway is an anthropological study of effective mechanisms for farmer participation in the design of crop and resource management technologies.

The **economics of genetic diversity** is an area in which CIMMYT Economics is becoming increasingly visible. We are plowing new ground in this area and hope to have several new products over the next five years. We have begun a comprehensive assessment of the costs and benefits of *ex situ* versus *in situ* conservation of genetic resources, which features the explicit quantification of the relationship between diversity and productivity. Prototype studies will be initiated in China and Australia. We are also examining several participatory approaches to *in situ* conservation, with emphasis on maize systems in Mexico.

Another area of Economics Program research consists of assessing the **long-term demand and supply** of wheat and maize. In this work we collaborate closely with IFPRI, Stanford University, and other institutions. We have supported the IFPRI 2020 projections by providing data and information on wheat and maize and will be actively involved in further iterations of that work. With Stanford University we are developing a project to assess the demand/supply of maize in China. We also plan to work with Asian national research systems to address the consequences of the exploding demand for maize in Asia, particularly for livestock feed.

We anticipate that the information obtained from all of the research described here will enhance our efforts in research priority setting and resource allocation for wheat and maize. We would like to improve our capabilities in research priority setting methods, including methods for setting priorities across crops and regions and also across research activities dedicated to a particular crop, such as crop improvement versus crop management research. We hope to work with several collaborators on this effort, including the University of California-Davis, North Carolina State University, and Virginia Tech.

Changes in strengthening NARS capacity

The CIMMYT Economics Program has always maintained a strong program dedicated to strengthening NARS research capacity. Until last year, we posted three senior scientists to the regions: one each in Africa, Central America, and Asia. We changed that allocation by adding an additional person in Africa and discontinuing the position in Asia. Given the growing economics capacity in Asia, we decided to relocate the Asia position to Africa and rely on Asian economists to work on Asian problems as CIMMYT Affiliate Economists. We now have two senior staff posted to Africa (based in Ethiopia and Zimbabwe) and one in Central America (Costa Rica).

Our approach to strengthening NARS capacity has also evolved over time. We have gone upstream in our training courses, are more involved in collaborative research, and do more back stopping of NARS research activities. Our training courses emphasize the interaction between technology, policy, and the environment. We also focus on providing improved analytical tools and methods. Collaborative research activities form the core of our NARS-strengthening efforts, and this research actively involves both outposted and headquarters staff. In addition to collaborative projects, our outposted staff play a crucial backstopping role in the regions by helping to identify research priorities, design research projects and survey instruments, use analytical tools, and interpret results.

The outposted staff perform a crucial function for the Program and are all highly respected in the regions where they work. Because the demand for outposted staff services often exceeds their capacity to supply them, we need to bring in additional resources from other institutions to augment and complement our resources. We also need to better integrate headquarters and outreach activities. We anticipate a future in which outreach staff participate more actively in the core research program and headquarters staff are more involved in backstopping outreach activities.

Staffing changes

The Economics Program is fully staffed today. We have 9 Senior Staff (6 posted to headquarters and 3 to the regions); 1 Rockefeller Fellow (starting July 1997); 3 Associate Scientists (1 at headquarters, 2 in the regions); 4 national staff, and a full complement of Research Associates and students. We plan to hire one Postdoctoral Fellow this year to work on the economics of biotechnology. In addition to the above, we work with several Affiliate Economists, university professors and NARS scientists who give us one to three months of their time per year.

The Economics Program within CIMMYT

The Economics Program has maintained very close relationships with the crops programs, both in *ex ante* analysis as well as in impact assessment. We are developing similar links with the Applied Biotechnology Center and with the newly established Natural Resources Group. Maintaining a strong group of social scientists in one central location with research commitments across other disciplinary programs has always served us well and we will continue to operate on that model.

Within the new project structure proposed in the Medium Term Plan, Economics Program staff have allocated time to several CIMMYT-wide projects (see Section 7). All of our research themes will be pursued within that project structure. In this briefing book, we show how the results of research in the Program's areas of work are expected to contribute to the CIMMYT-wide projects (see Sections 2-5).

Issues for the Consideration of the Review Panel

As mentioned earlier, in this external review we seek both a critical assessment and an endorsement of our plans as we orient ourselves for the next decade. Although we expect the Review Panel to raise its own concerns and opinions with respect to the research agenda described here, we would like to add a small number of our own concerns for the Panel's consideration.

- What is the Panel's opinion of our current research emphasis, especially in relation to the recommendations emerging from prior reviews? Will the present/projected research agenda provide the information that CIMMYT needs to understand the larger issues affecting the efficiency and impact of its research -- particularly relatively new areas of research such as biotechnology?
- What is the Panel's opinion of the Economics Program research agenda in relation to CIMMYT's new project structure, described in the Medium-Term Plan? Does the Panel foresee any opportunities or dangers that Program staff have perhaps not considered?

- In light of CIMMYT's apparently growing need for information on research impacts and for setting priorities within the Center, how can we ensure that the Program's service/information role does not overwhelm other research initiatives that may be more original and forward-looking? (With regard to the Program's service function, see the concerns raised about the *Facts and Trends* series; see Section 6).

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The next sections of this briefing book contain an overview of Economics Program projects, organized by the areas of work we have just described. This is followed by information on the *Facts and Trends* series; a staff list and biodata; and a list of staff publications from 1994 to 1997. We are also forwarding copies of selected staff publications to offer a more detailed view of our research.

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2. Impact Assessment

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2.1	Impact Assessment within the New CIMMYT Project Structure	
	Projects	Status
2.2	Global Impacts of CIMMYT Maize Germplasm Improvement Efforts	Current
2.3	Global Impacts of CIMMYT Wheat Germplasm Improvement Efforts	Current
2.4	International Spillovers of Research in Latin America and the Caribbean	Future
2.5	Role of Intellectual Property Rights in the Design of International Agricultural Research Collaboration	Current
2.6	Gender Research at CIMMYT: Notes toward the Development of a Research Agenda	Current
2.7	Participatory Research at CIMMYT: Notes toward the Development of a Research Agenda	Current
2.8	Organization and Performance of Maize Seed Industries	Completed
2.9	Monitoring the Use of Improved Maize Seed and Fertilizer in Malawi	Current
2.10	Adoption of Improved Maize Germplasm in Ghana	Planned

2.1. Impact Assessment within the New CIMMYT Project Structure

Economics Program research on impact assessment contributes to CIMMYT's overall goals for Global Project 7, "Gauging the Productivity, Equity, and Environmental Impacts of Modern Maize and Wheat Production Systems," described in CIMMYT's Medium-Term Plan as follows.

Objective:

- To provide a balanced and objective assessment of the impacts of modern maize and wheat production systems.

Problems Addressed:

- Lack of reliable data on the positive and negative impacts of modern wheat and maize production systems.
- Poor policy formulation caused by the lack of reliable, country-specific information on maize and wheat impacts.

By the year 2000...

- A global wheat germplasm impact study will be completed.
- A global maize germplasm impact study will be completed.
- We will have accessed the gender differences in Sub-Saharan African maize farming systems.
- The spillover benefits for Latin America of maize and wheat research will be assessed and the implications for enhancing the efficiency of the region's research systems will be derived and documented.
- The impact of maize technological change in Ghana will be quantified.
- A global assessment will be done of the impact of the Green Revolution in wheat and future prospects for productivity growth.

2.2. Global Impacts of CIMMYT Maize Germplasm Improvement Efforts

Duration:

1997-1999

Objectives:

- To document the global impacts of international maize breeding efforts.
- To determine use of CIMMYT maize germplasm products by different users (public breeding programs, private seed companies, NGOs).
- To generate information for use by management of the CIMMYT Maize Program in establishing maize research priorities.
- To generate information that can help CIMMYT management formulate effective germplasm deployment strategies.

Participants:

CIMMYT Economics Program staff (Michael Morris, Miguel López-Pereira, Wilfred Mwangi, Mulugetta Mekuria, Ricardo Calvo, Prabhu Pingali, Paul Heisey). CIMMYT Maize Program staff (Ganesan Srinivasan).

Activities:

We are in the process of updating and extending the 1992 global maize impacts study. One important new goal is to strengthen our knowledge of the activities of private seed companies, about which relatively little was learned during the previous study.

To make data collection more manageable, the global maize impacts study has been divided into three regional studies, to be pursued sequentially:

1. Latin America (carried out with assistance from Miguel López-Pereira and from the BID-funded economist to be hired in 1997).
2. Africa (coordinated by Mulugetta Mekuria and Wilfred Mwangi).
3. Asia (carried out with the assistance of 8-10 NARS collaborators who will be responsible for studies in key maize-producing countries).

Progress to Date:

- Public- and private-sector questionnaires have been developed and pre-tested.
- Data collection activities for Central America have been completed (including interviews with virtually all of the private seed companies that conduct maize breeding activities). A preliminary report on the impacts of international maize breeding activities in Central America and Mexico is being drafted.
- Data collection strategy for Africa is being developed.

Key Publications:

López -Pereira, M.A., and M.L. Morris. 1994. *Impacts of International Maize Breeding Research in the Developing World, 1966-1990*. Mexico, D.F.: CIMMYT.

Morris, M.L., C. Clancy, and M.A. López -Pereira. 1992. Maize research investment and impacts in developing countries. Part 1 in *1991-92 CIMMYT World Maize Facts and Trends*. Mexico, D.F.: CIMMYT.

2.3. Global Impacts of CIMMYT Wheat Germplasm Improvement Efforts

Duration:

1997-1999

Objectives:

- To document the global impacts of international wheat breeding efforts.
- To determine use of CIMMYT wheat germplasm products by different users.
- To generate information for use by management of the CIMMYT Wheat Program in establishing wheat research priorities.
- To generate information that can help CIMMYT management formulate effective germplasm deployment strategies.

Participants:

Paul Heisey; Mina Lantican; Jesse Dubin; numerous other Wheat, Economics, and NRG staff (headquarters and outreach); numerous collaborators in the developing world.

Activities:

We are in the process of updating and extending the 1993 global wheat impacts study. Important new goals include obtaining a better understanding of varietal use by megaenvironment and obtaining more complete coverage of China. For this research, we will:

- Develop and distribute questionnaires.
- Update and integrate wheat megaenvironment information.
- Develop database and integrate with database from previous wheat impacts study, as well as with the International Wheat Information System (IWIS).
- Obtain and analyze supporting information on progress in yield and other crop improvement goals.
- Draw out implications for organization and functioning of the international wheat improvement system.
- Draw out implications for the allocation of research resources.

Progress to Date:

Questionnaires have been developed and distributed to 40 countries in the developing world. Preliminary work has started on updating the megaenvironment database.

Key Publications:

Byerlee, D., and P. Moya. 1993. *Impacts of International Wheat Breeding Research in the Developing World, 1966-1990*. Mexico, D.F.: CIMMYT.

Bohn, A., and D. Byerlee. 1993. The wheat breeding industry in developing countries: An analysis of investments and impacts. Part 1 of 1992/93 *CIMMYT World Wheat Facts and Trends*. Mexico, D.F.: CIMMYT.

Byerlee, D., and G. Traxler. 1995. National and international wheat improvement research in the Post-Green Revolution period: Evolution and impacts. *American Journal of Agricultural Economics* 77: 268-278.

2.4. International Spillovers of Research in Latin America and the Caribbean

Duration:

1997-2000

Objectives:

The objective of this research is to improve the efficiency of agricultural research investments in Latin America and the Caribbean (LAC) by capturing technology spillovers and minimizing the duplication of research effort. Research administrators' desire to assist poor producers and to increase resource allocations to research on sustainable agricultural systems has been frustrated in recent years by the reality of declining real budgets. Identifying technology spillover patterns and redundant research activities offers a means of reallocating existing resources toward needed research on poor farmers and sustainable systems.

Actual and potential spillovers in maize and wheat research in LAC will be examined at three levels:

- flows of pretechnology research outputs;
- flows of farm-level production technologies; and
- assessing the scientific capacity of LAC institutions.

Flows of farm-level production technologies will be assessed for three different types of technology – wheat and maize varieties, crop management innovations, and natural resource management practices. Results of the analysis should provide a unique, comprehensive picture of the process of technical change in agriculture in the region.

Specifically, the project will:

- Identify flows of pretechnology genetic research.
- Describe and document patterns of maize and wheat germplasm spillovers in LAC.
- Describe and document patterns of technology borrowing in crop management and natural resource management practices in maize- and wheat-based systems.
- Measure and quantify the direction and volume of these spillovers.
- Calculate rates of return to individual research programs with and without accounting for spillovers.
- Identify opportunities for streamlining and increasing the returns to research investments.
- Assess the scientific capacity of LAC agricultural research institutions.

Participants:

CIMMYT Economics Program staff (Prabhu Pingali; new researcher hired for project; Paul Heisey; Michael Morris); an Affiliate Economist (Greg Traxler, Auburn University); Advisory Committee (Robert Evenson, Yale University; Edgardo Moscardi, IICA; Philip Pardey, IFPRI); NARS economists in the region.

Activities:

- Recruitment of a visiting scientist and postdoctoral fellow from the LAC region.
- Organization of a preliminary planning workshop and identification of collaborators in national agricultural research programs and in universities.
- Development of a database on maize and wheat germplasm flows within LAC and between LAC and the rest of the world.
- Development of a database on crop management technologies and natural resource management practices for selected systems.
- Estimation of farm use of germplasm, crop management technologies, and natural resource management practices.

- Estimation of resources deployed in research programs.
- Estimation of the rate of genetic gain achieved by breeding programs in each target production environment.
- Estimation of other technology-related supply shifts, e.g., such as those arising from the diffusion of crop management technology.
- Estimation of rates of return to research investments with and without accounting for spillovers, for selected cases.
- Technical collaboration and monitoring of case study research carried out by collaborators.
- Organization of mid-project workshop with the interaction of network participants and presentation of preliminary results.
- Organization of a closing workshop at the end of the project, in which research results are presented to research policy makers.

Progress to Date:

A CIMMYT regional economist for LAC is being recruited.

2.5. Role of Intellectual Property Rights in the Design of International Agricultural Research Collaboration

Duration:

1996-1997

Objectives:

To improve the efficiency of collaborative agricultural research networks working in the Central America and Caribbean Region by identifying the institutional arrangements under which technology spillovers and opportunities for research joint ventures are maximized.

Specifically the project aims to:

- Assess past, current, and likely future germplasm flows among Central American and Caribbean countries.
- Identify the legal, institutional, and economic factors that influence germplasm flows.
- Identify the intellectual property rights structures needed to maximize access to improved germplasm in an efficient and equitable manner among network members.

Participants:

CIMMYT (Gustavo Sain and other staff), PRM, RCSE, IICA, NARSs, NGOs.

Activities:

- Organization of an initial regional planning workshop to inform all parties involved about the main issues under discussion, their importance for collaborative research, and potential implications for the future.
- Organization of a final regional workshop to discuss the set of rules identified in the previous activity and to gain regional endorsement.
- Identification of current and likely future legal and institutional arrangements under which germplasm flows occur.
- Identification and measurement of spillovers from regional and international breeding efforts.
- Identification of potential areas of conflict and common interest under different scenarios of enforcement of intellectual property rights.
- Development of a set of recommendations for the collaborative networks working in the region, including the rules necessary to minimize conflicts of interest and to maximize flows of germplasm.

Progress to Date:

Results summarized in:

Sain, G. y M. Jauregui. 1997. Redes regionales de investigación agrícola, flujo de germoplasma y derechos de propiedad intelectual en América Central. Presented at the XLIII Annual Meeting of the Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos y Animales (PCCMCA), 16-20 March, Panama City, Panama.

2.6. Gender Research at CIMMYT: Notes toward the Development of a Research Agenda

Duration:
1997 -2000

Objectives:

Interest in the gender dimensions of agricultural research has risen with the recognition that agricultural research has tended to focus on male farmers and to assume a monolithic view of households. Gender analysis is a response to these biases. It aims to understand the dynamics of domestic agricultural production by investigating the roles that various household members play in household production and consumption according to their age and sex (Feldstein and Curry 1995). Clearly, gender analysis is not concerned only with females or female-headed households, but rather with intrahousehold structure and function. In the context of agricultural research at CIMMYT, several questions should be addressed by a gender research program:

- How do intrahousehold structure and function affect the adoption of CIMMYT technology?
- Once adoption has occurred, what are its impacts on intrahousehold structure and function?
- How can we predict the impact of CIMMYT technology on household structure and function?
- When does a potential/actual impact merit an intervention (e.g., a modification of the technology)?
- What interventions can CIMMYT make with regard to a technology or the institutional aspects associated with a technology?

See the Figure, next page, for a diagrammatic representation.

Participants:

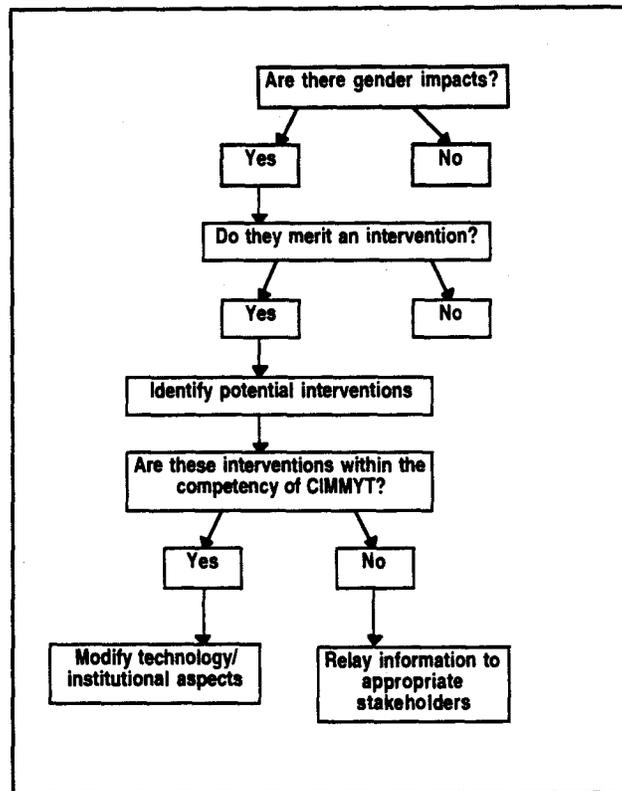
Economics Program (Mauricio Bellon and others), Maize and Wheat Programs, Natural Resources Group, farmers/other stakeholders, NARSs, NGOs, Cheryl Doss (Williams College).

Activities:

CIMMYT needs to build an empirical base to answer the questions listed earlier in relation to specific technologies the Center has generated. This should be done through case studies of specific CIMMYT technologies in particular regions of the world, using a comparative approach to distinguish the general aspects from the location-specific ones. The technologies to be studied should be chosen on the basis of their importance to fulfilling the CIMMYT mandate. The lessons of these case studies should be the basis for:

- Standard methodologies to assess *ex ante* and *ex post* gender impacts of a technology.
- Criteria to assess whether the potential impacts of a technology merit its modification to respond to gender concerns.
- Criteria to assess which modifications can be made by CIMMYT and which are outside its competency.
- A procedure to incorporate these criteria in the screening of new technologies generated by CIMMYT.

Flow chart, gender research.



Reference:

Feldstein, H.S., and J.J. Curry. 1995. Gender audit methods paper. Unpublished manuscript.

2.7. Participatory Research at CIMMYT: Notes toward the Development of a Research Agenda

Duration:
1997 -2000

Objectives:

The growing recognition that the participation of farmers and other stakeholders in developing and testing a technology can improve its adoption and the net benefits that it generates has led to different methods and philosophies for incorporating farmers into agricultural research. CIMMYT has been a leader in this respect, with its contributions to farming systems research and on-farm research (Byerlee, Harrington, and Winkelmann 1982; Tripp and Woolley 1989). The Center recognizes that farmer participation will continue to be significant for the success of knowledge-intensive technologies, which it considers crucial to increasing maize and wheat productivity in years to come (CIMMYT 1997). The goals of participatory research at CIMMYT should include:

- To identify which farmers and other stakeholders should be included in the process of bringing users' perspectives and concerns into the development and testing of agricultural technologies.
- To determine which perspectives and concerns remain similar across cultures and locations and which do not.
- To identify gaps between farmers' and scientists' perceptions of problems affecting farmers, and the technologies that scientists generate to address them.
- To close this gap by incorporating farmers' perspectives and concerns into the development and testing of CIMMYT technologies, and by providing relevant information to farmers and other stakeholders.

Participants:

Economics Program (Mauricio Bellon and others), Maize and Wheat Programs, Natural Resources Group, farmers/other stakeholders, national research programs, NGOs.

Activities:

To accomplish the goals listed previously, a CIMMYT participatory research program should develop:

- Standard methodologies to elicit farmers' knowledge and perceptions and to understand their decision-making process.
- Standard methodologies to assess whether there is a gap between the perspectives and concerns of farmers and those of scientists in relation to specific technologies being developed or tested.
- Criteria to assess whether there is a need to close this gap.
- Procedures to close this gap, both by incorporating farmers' perceptions and concerns into the development and testing of CIMMYT technologies, and by providing relevant information to farmers and other stakeholders.

To develop these outputs, CIMMYT should carry out case studies of specific technologies in particular regions of the world. The technologies to be studied should be chosen on the basis of their importance to fulfilling the CIMMYT mandate.

References:

- Byerlee, D., L. Harrington, and D. L. Winkelmann. 1982. Farming systems research: Issues in research strategy and technology design. *American Journal of Agricultural Economics* 64: 897-904.
- CIMMYT. 1997. *People and Partnerships: Medium-Term Plan of the International maize and Wheat Improvement Center (CIMMYT), 1998-2000+*. Mexico, D. F.: CIMMYT.
- Tripp, R., and J. Woolley. 1989. *The Planning Stage of On-Farm Research: Identifying Factors for Experimentation*. Mexico, D.F., and Cali, Colombia: CIMMYT and CIAT.

2.8. Organization and Performance of Maize Seed Industries

Duration:

1992-1997

Objectives:

1. To improve our understanding of the organization and performance of public and private maize seed industries.
2. To inform decision makers who are involved in seed industry policy formulation.
3. To generate information that can help CIMMYT breeding programs develop more effective strategies for delivering improved germplasm to farmers.
4. To generate information that can help CIMMYT management formulate more effective working relationships with private seed companies.

Participants:

CIMMYT Economics Program staff (Michael Morris, Paul Heisey, Jim MacMillan, Melinda Smale, Miguel López-Pereira, Gustavo Sain, Pedro Aquino, Michael Fillipello). NARS collaborators (R.P. Singh, IARI; Suresh Pal, NCAP; João Carlos Garcia, EMBRAPA; Joseph Rusike, University of Zimbabwe).

Activities:

Case studies have been carried out on the national maize seed industries of India, Mexico, Brazil, Thailand, and Malawi. These case studies usually have involved surveys of public and private breeding programs and seed organizations.

Although this project on maize seed industries comes to an end in 1997, work on seed industries continues under several projects described in this book. For example, follow-up studies in several countries focus on farm-level seed management practices (India, Mexico, Malawi).

Progress to Date:

- CIMMYT Economics Program Working Papers (Mexico, Brazil, India case studies).
- Feature report on maize seed industries in 1993/94 *World Maize Facts and Trends*.
- Edited book on maize seed industries in developing countries (forthcoming 1998).
- CIMMYT seminar summarizing work on maize seed industries.

Key Publications:

- López-Pereira, M.A., and M.P. Fillipello. 1994. *Emerging Roles of the Public and Private Sectors of Maize Seed Industries in the Developing World*. CIMMYT Economics Program Working Paper 94/02. Mexico, D.F.: CIMMYT.
- López -Pereira, M.A., and M.P. Fillipello. 1994. Maize seed industries revisited: Emerging roles of the public and private sectors. Part 1 in 1993-94 *CIMMYT World Maize Facts and Trends*. Mexico, D.F.: CIMMYT.
- López -Pereira, M.A., and J.C. Garcia. 1997. *The Maize Seed Industries of Brazil and Mexico: Past Performance, Current Issues, and Future Prospects*. CIMMYT Economics Program Working Paper 97/02. Mexico, D.F.: CIMMYT.
- Morris, M.L. (ed.). *Maize Seed Industries in Developing Countries*. Boulder, Colorado: Lynne Rienner Publishers (forthcoming, 1998).
- Singh, R.P., and M.L. Morris. *Adoption, Management, and Impacts of Hybrid Maize in India*. Economics Working Paper. Mexico, D.F.: CIMMYT (forthcoming).
- Singh, R.P., S. Pal, and M.L. Morris. 1995. *Maize Research and Development and Seed Production in India: Contributions of the Public and Private Sectors*. CIMMYT Economics Program Working Paper 95/03. Mexico, D.F.: CIMMYT.

2.9. Monitoring the Use of Improved Maize Seed and Fertilizer in Malawi

Duration:

1996-1998

Objectives:

Relate the use of improved maize seed and fertilizer to major economic, political, and institutional changes occurring in Malawi in order to provide (1) a better understanding of research impact and (2) policy feedback to the national program and other Malawian institutions.

Participants:

Economics Program (Melinda Smale); Rockefeller Foundation, Malawi; Alexander Phiri, Bunda College; Monitoring and Evaluation Units of the Agricultural Development Divisions of the Malawi Ministry of Agriculture.

Activities:

- Repeated sample survey of farm households.
- Updating of national crop estimates and seed sales figures.
- Data analysis and report preparation.
- Interaction with representatives from Malawian institutions.

Progress to Date:

- Original household list, enumerators, and supervisory staff re-established.
- 1996-97 survey implemented and data analyzed.
- Working paper drafted.

2.10. Adoption of Improved Maize Germplasm in Ghana

Duration:

1997-1998

Objectives:

As part of its ongoing effort to monitor and evaluate the impacts of its maize research, CIMMYT proposes to study the factors affecting the adoption and diffusion of improved maize germplasm in Ghana. The Ghana Maize Impacts Study will form one of a series of adoption case studies being prepared by various CGIAR centers and NARSs, with assistance from the CGIAR-sponsored Impacts Assessment and Evaluation Group (IAEG).

Ghana makes a particularly attractive choice for this study for a number of reasons:

1. There is a long history of CIMMYT involvement in Ghana through the CIDA-funded Ghana Grains Improvement Project.
2. Adoption of improved maize germplasm in Ghana appears to have accelerated in recent years, suggesting that important lessons can be learned from the Ghanaian experience.
3. Earlier adoption studies carried out by CIMMYT and CRI provide a comprehensive set of baseline data which are unavailable elsewhere.
4. Research on farmers' seed management practices currently being planned by Robert Tripp of ODI (with funding from ODA) would nicely complement this proposed study.

Specific objectives include:

- To document the diffusion of improved maize germplasm by means of a national survey of maize producers.
- To analyze microlevel factors influencing the uptake and management of improved germplasm (i.e., household resources, farmer knowledge, performance of the technology in farmers' fields).
- To analyze macrolevel factors influencing the adoption and diffusion of improved germplasm (i.e., price policies, inputs supply systems, rural infrastructure).

Participants:

CIMMYT Economics staff (Michael Morris), researchers from the Ghana CRI (to be identified) and ODI (Robert Tripp). CIDA will contribute funds towards the study.

Activities:

A tentative time frame has been developed for the study. Activities will include:

- Identification of CRI collaborators.
- Development of a preliminary work plan.
- Sampling frame design.
- Drafting of questionnaire.
- Enumerator training course and field survey.
- Data entry and cleaning.
- Collaborators would convene at a site to be determined later to draft initial report.
- Preparation of final report.

Progress To Date:

Questions of funding and planning are still being worked out.

3. Technology Design/Forecasting and Priority Setting

Contents

3.1	Technology Design/Forecasting and Priority Setting within the New CIMMYT Project Structure	
	Projects	Status
3.2	Economics of Biotechnology	
	3.2.1.	Maize apombcis
		Planned
	3.2.2.	Marker-assisted selection
		Planned
3.3	Technology Options for Drought-Prone, Maize-Producing Areas	
		Current
3.4	Evaluating the Potential Impact of Protein- or Micronutrient-Enriched Maize and Wheat Varieties	
		Current
3.5	Research Priority Setting within CIMMYT: Observations and Issues	

3.1. Technology Design/Forecasting and Priority Setting within the New CIMMYT Project Structure

<p>Economics Program research on technology design/forecasting and priority setting contributes to CIMMYT's overall goals for Frontier Project 6, "Priority Setting and Technology Forecasting for Increased Research Efficiency" and Frontier Project 2, "Apomixis – Equity in Access to Hybrid Vigor for Resource-poor Farmers," as follows (adapted from CIMMYT's Medium-Term Plan).</p>
<p>Priority Setting and Technology Forecasting for Increased Research Efficiency</p>
<p>Objective:</p> <ul style="list-style-type: none"> • To assess long-term technology needs for the developing world's maize and wheat farmers. • To evaluate the likely technical, economic, environmental, and social impacts of emerging technologies that are still "in the pipeline." • To strengthen priority setting in research resource allocation for maize and wheat, based on constraints analysis and technology forecasting. • To generate information that can help CIMMYT management formulate effective technology deployment strategies.
<p>Problems Addressed:</p> <ul style="list-style-type: none"> • Inefficient allocation of scarce research resources in national programs and international research centers. • Excessive and unnecessary duplication of research.
<p>By the year 2000...</p> <ul style="list-style-type: none"> • An <i>ex ante</i> assessment of the impact of biotechnology on maize productivity growth will be completed, with particular emphasis on apomixis and marker-assisted selection. • The technological prospects for unfavorable maize and wheat production environments will be assessed. • Methods will be developed for assisting in the allocation of resources across crops and major activities within a particular crop research program.
<p>Apomixis – Equity in Access to Hybrid Vigor for Resource-poor Farmers</p>
<p>Objective:</p> <ul style="list-style-type: none"> • Production of apomictic maize germplasm. • Characterization and isolation of the gene(s) controlling apomixis. • Development of genetic engineering protocols to test apomixis expression and transfer apomixis to crops other than maize. • Development of new breeding strategies that take advantage of apomictic varieties. • Development of deployment strategies for apomictic varieties in small-scale farming systems.
<p>Problems Addressed:</p> <ul style="list-style-type: none"> • Small-scale farmers have limited access to seed of improved varieties, especially hybrids, and recycle their own seed, which results in heterogeneous, low-yielding crops. Once apomixis is introduced into varieties made available to farmers, it would allow the fixation of beneficial genes and the preservation of advantageous characteristics, such as heterosis, generation after generation.
<p>By the year 2000...</p> <ul style="list-style-type: none"> • Information will be developed regarding the potential impact of apomictic varieties in developing countries. • Draft strategies will be developed for the use and deployment of apomictic maize varieties.

3.2. Economics of Biotechnology

Duration:
1997-2000+

Objective:
To conduct an *ex ante* assessment of the impact of biotechnology on maize and wheat productivity growth, with initial emphasis on apomixis and marker-assisted selection.

Participants:
Economics Program, Applied Biotechnology Center, advanced research institutes, NARSs.

Activities:
See the project descriptions that follow.

3.2.1. Maize apomixis

Duration:
1997-2000

Objectives:
Until now, most CIMMYT research on apomixis has focused on technical issues. In view of recent technical progress, it now seems much more likely that apomictic maize may one day become a reality. The objective of this proposed research is to examine a number of important economic, social, and political issues which are likely to arise in the deployment of apomictic maize. Results of this research will be used for at least three purposes:

- To inform research resource allocation within CIMMYT.
- To help CIMMYT develop an effective deployment strategy. A key question for CIMMYT is the degree to which apomixis-related intellectual property should be protected through confidentiality agreements, patenting, and/or other means.
- To educate CIMMYT's partners, funding agencies, and clients about these issues.

Participants:
Staff of the Economics Program, Applied Biotechnology Center, and possibly the Maize Program.

Activities:
Although detailed research agendas have not yet been developed for the CIMMYT projects described in the recent Medium-Term Plan, presumably this work will come under one or two of those projects:

- Frontier Project 2: *Apomixis – Equity in Access to Hybrid Vigor for Resource-Poor Farmers;*
- Frontier Project 6: *Priority Setting and Technology Forecasting for Increased Research Efficiency.*

Specific research topics likely to be addressed include:

- Implications of apomixis for cost of commercial seed production.
- Implications of apomixis for the economics of adoption at the farm level.
- Regions in which apomictic maize is likely to be economically viable.
- Environmental risks associated with deployment of apomictic maize.

3.2.2. Marker-assisted selection

Duration:
1997-2000

Objectives:

In principle, the great advantage of marker-assisted selection is that it makes possible early identification of plants containing a gene or genes of interest, which means that breeders can avoid the time and expense involved in growing out field trials to permit visual selection of plants showing the desired trait. The objective of this research is to conduct a rigorous economic analysis comparing the cost of marker-assisted selection to the cost of conventional breeding.

Marker-assisted selection is likely to offer a cost-effective alternative to conventional breeding under two conditions:

1. If the heritability of the trait being selected for is high, but if costly field conditions are required to ensure its expression, marker-assisted selection will reduce the amount of field testing needed and thus significantly reduce the cost and/or time required for transfer. A good example is resistance to certain viruses, which will not express in locations where the virus does not occur. Breeders at CIMMYT-Mexico face this problem in attempting to screen for maize streak virus; experimental materials must be shipped at considerable expense to CIMMYT-Zimbabwe, where field trials can be planted.
2. If environmental effects are high, the trait being selected for will tend to have low heritability, making classical selection inefficient. In such cases, marker-assisted selection could improve selection efficiency, even though the percentage of phenotypic variance controlled by the quantitative trait loci (QTL) would be low. A good example is drought tolerance, which appears to be controlled by several genes and whose expression is frequently confounded by environmental variables which are difficult to control. Although progress in drought tolerance can be achieved through conventional selection methods, trials must usually be replicated across a large number of locations and across several years before the expression of the trait can be identified conclusively.

Activities:

A detailed research agenda has not yet been developed. However, activities are likely to include the development of a case study or studies, in which a marker-assisted selection effort that has been successful in an applied breeding program would be compared with a conventional breeding program that aims to accomplish the same purpose.

3.3. Technology Options for Drought-Prone, Maize-Producing Areas

Duration:

1997-1999

Objectives:

Enumerate technology options for maize production in drought-prone areas; evaluate development and diffusion costs and potential benefits; evaluate and refine methodology for defining "marginal areas" and setting research priorities for these areas.

Participants:

Paul Heisey, Mina Lantican (Economics Program); Mitch Renkow (North Carolina State University); Greg Edmeades, Marianne Bänziger (Maize Program); NRG Risk Management project participants.

Activities:

- Review literature on drought, marginal areas, and poverty as related to research priority setting.
- Develop a list of present and potential technologies for maize production in drought-prone areas.
- Assess the potential impact of these technologies across geographical regions and across environments characterized by ecological and socioeconomic criteria.
- Develop a conceptual model for addressing the allocation of research resources to marginal areas within the standard economic surplus approach; assess currently available methods for incorporating poverty criteria in research resource allocation.
- Evaluate data availability and computational and time requirements against the need for theoretical soundness, for alternative methods of research resource allocation in marginal areas.
- Produce theme article for *1997/98 World Maize Facts and Trends*.

Progress to Date:

Affiliate Scientist (Mitch Renkow) identified to work on more formal methods of research resource allocation. Literature search initiated on moisture stress, marginal environments, and poverty issues in research resource allocation.

3.4. Evaluating the Potential Impact of Protein- or Micronutrient-Enriched Maize and Wheat Varieties

Duration:

1996-1998

Objectives:

Develop and apply methodologies for assessing the nutritional and economic impacts of feasible increases in bio-available protein in maize or micronutrients in maize and wheat.

Participants:

Marianne van Dorp, Paul Heisey (Economics Program), CIMMYT Maize and Wheat Programs, Purdue University.

Activities:

- Review literature on nutritional impacts of agricultural research.
- Review literature on food consumption and nutrition, focusing on countries where maize and wheat are important parts of the human diet.
- Revise, expand, and apply models of nutritional impact from changes in protein or micronutrient content of staple foods.
- Assess economic benefit associated with nutritional impact.
- Assess development and policy costs associated with the diffusion of quality protein maize or micronutrient-enriched varieties.
- Draw implications for the allocation of research resources.

Progress to Date:

Working papers have been drafted on:

- prospects for quality protein maize in countries with a high percentage of human calories coming from maize; and
- the potential for combating micronutrient deficiencies through plant breeding.

3.5. Research Priority Setting within CIMMYT: Observations and Issues

The last internally managed external review stated that in principle there is a need to increase the support from the Economics Program to ongoing priority-setting processes within CIMMYT. The level of support would be on the order of one full-time equivalent senior staff position; methodologies should be expanded beyond those currently used. The review panel felt strongly, however, that this work should not be done at the expense of the Program's work related to private sector initiatives in maize research; *Facts and Trends*; and *ex post* research evaluation. Therefore, at least an additional person year would be required beyond the minimal three core positions.

Given the below-minimal level of staffing within the Program for much of the past three years, no new in-house initiatives in research resource allocation and priority setting were begun. However, many Economics Program projects have a component with implications for research resource allocation. For example, work on maize impacts led to studies of the maize seed industry in developing countries, which in turn led to analysis of the research resource allocation implications of alternative forms of seed industry structure. Work on wheat impacts led to studies of economies of scale, spillovers, and the efficient organization of the international wheat research system. Research on the economics of genetic diversity has implications for understanding the cost effectiveness and probability of success of tapping different sources of genetic diversity in the pursuit of plant breeding objectives. Other examples can be found in other projects listed in this book.

In addition, in 1996 the Program sponsored two consultancies on priority setting. The first, by Burt Sundquist, looked at the methodological adequacy of past priority setting exercises in CIMMYT, analyzed the degree to which these exercises may have influenced the resource allocations in the Center, considered the usefulness of "state of the art" methods in priority setting for CIMMYT's needs, and explored the degree to which funding constraints determine the areas of CIMMYT's research. The second consultancy, by Greg Traxler, explored the growth of research capacity in developing countries and further analyzed the role of technology spillovers and economies of size in the efficient design of agricultural research systems.

Also, as has been the case for many years, the Economics Program has provided informal consultation to CIMMYT management on matters related to priority setting. One example is the responses to statements from the TAC regarding global research priorities, and the justifications given by that body. This informal consulting role will continue with advice provided in the implementation of the new Medium-Term Plan.

Some issues remain to be resolved with respect to these activities. First, the persistent question of how much of its own resources the Program should devote to priority setting has yet to be resolved. Second, methodological adequacy and feasibility of implementation are often perceived to be conflicting goals. How should this apparent conflict be settled? Finally, can and should the research resource allocation components of individual projects, and informal consultations with CIMMYT management, be institutionalized more formally within the Center, regardless of the overall level of commitment to priority setting?

4. Economics of Genetic Diversity

Contents

4.1	The Economics of Genetic Diversity within the New CIMMYT Project Structure		
Projects		Status	
4.2	Economics of Genetic Diversity		
	4.2.1.	International symposium on the economics of genetic diversity	Current
	4.2.2.	The impact of genetic diversity on wheat crop productivity: a comparative analysis of China and Australia	Planned
	4.2.3.	Costs of storage and maintenance of <i>ex situ</i> cereal germplasm	Current
	4.2.4.	Maize diversity management and utilization: a farmer-scientist collaborative approach	Current

4.1. The Economics of Genetic Diversity within the New CIMMYT Project Structure

Economics Program research on genetic diversity contributes to CIMMYT's overall goals for Global Project 1, "Conservation and Management of Genetic Resources," described in CIMMYT's Medium-Term Plan as follows.

Objective:

- To promote the collection, conservation, evaluation and the equitable sharing of maize, wheat, and triticale genetic resources, and appropriate wild relatives.

Problems Addressed:

- Threats to genetic diversity from rising human populations and changing land use patterns.
- Genetic erosion and gaps in *ex situ* collections.
- Under-utilization of genetic diversity in the development of modern cultivars.
- Inadequate documentation or characterization of current holdings, and a lack of general access to current information by potential users.
- Limited equitable sharing of germplasm between countries and within countries.
- Uncertainties in the emerging germplasm acquisition and intellectual property right policies.
- Lack of information on socioeconomic and policy determinants of diversity in maize and wheat grown in farmers' fields.

By the year 2000...

- We will be able to determine the full costs of genebank operations for the conservation of maize and wheat, compared to other conservation options.
- Methods will be developed for estimating: 1) the economic value of accessions in the wheat collection, 2) the economic impact of different types of genetic resources and their diversity on productivity and yield stability in farmers' fields, and 3) the economic and genetic impact of on-farm improvement of landraces in rural Mexican communities.

4.2. Economics of Genetic Diversity

Duration:

1994-2000

Objective:

Build a theoretical and empirical basis for economic analysis of genetic resource use and diversity in maize and wheat.

Participants:

Scientists in CIMMYT's Economics, Maize, and Wheat Programs; university and national program collaborators.

Activities:

- Integration of definitions and measurements of genetic diversity from an interdisciplinary perspective (see "International symposium on the economics of genetic diversity," below).
- Document global trends in utilization of wheat genetic resources and their diversity.
- Develop/refine economic methods for analysis of productivity and stability impacts of genetic resources and diversity (see "The impact of genetic diversity of wheat crop productivity: a comparative analysis of China and Australia").
- Develop/refine methods for valuation of genetic resources and diversity conserved *ex situ* (see "Costs of storage and maintenance of *ex situ* cereal germplasm").
- Develop/refine methods for economic analysis of prospects for on-farm conservation of genetic resources and diversity (see "Maize diversity management and utilization: a farmer-scientist collaborative approach").

Progress to Date:

- CIMMYT *World Wheat Facts and Trends: Supplement* (1995) and *Part 1* (1996); several public relations materials; 4 working papers; 2 journal articles.
- M.Sc. thesis, working paper, and journal submission focusing on integrating genetic attributes into conventional production function analysis.
- Journal article applying impure public goods model to analysis of diversity and rust resistance.
- Draft manuscript applying search model to valuation of marginal accessions in wheat genebank.
- Working papers (1 completed, 2 drafted) related to on-farm conservation; support to Ph.D. thesis.
- Draft manuscript reviewing the use of various methods to simulate the benefits from breeding research that arise from diversifying the genetic base of resistance to rust in wheat.
- Initial conceptual model for economic interpretation of farmers' decisions and their management of genetic diversity.

4.2.1. International symposium on the economics of genetic diversity

Duration:

August 1997

Objectives:

The title of the symposium reflects its objectives: "Building the Theoretical and Empirical Basis for the Economics of Genetic Diversity and Genetic Resource

Conservation in Crop Plants." The symposium is to be held at Stanford University, California, 16-19 August 1997.

Participants:

The following persons have been invited to attend the symposium as contributors and/or moderators and observers: Mauricio Bellon, Paul Heisey, Michael Morris, Prabhu Pingali, Melinda Smale (organizer) (CIMMYT); Stephen Brush, Eric van Dusen (University of California, Davis); David Cleveland (University of California, Santa Barbara); Pierre Crosson (Resources for the Future); Robert Evenson (Yale University); Douglas Gollin (Williams College); Jason Hartell (Katholieke Universiteit Leuven); Even Hentschel (Lehrstuhl fuer Agrarpolitik); Dominique Louette (CIMMYT Affiliate Scientist); Erika Meng (Rockefeller Postdoctoral Fellow, CIMMYT); Phil Pardey (International Food Policy Research Institute); Hugo Perales; Elizabeth Rice (Cornell University); Rosamund Naylor, Scott Rozelle, Donald Kennedy (Stanford University); Miguel Altieri, Arthur Small, Brian Wright, David Zilberman (University of California, Berkeley); Daniela Soleri (University of Arizona); Greg Traxler (Auburn University); Detlef Virchow (University of Kiel).

Progress to Date:

Papers to be presented include (tentative titles):

- "Farmers' Perceptions and Variety Selection: Implications for On-Farm Conservation of Rice" (Bellon)
- "Valuing a Gene Bank for Agricultural Productivity: Empirical Evidence from Wheat" (Gollin)
- "The Contribution of Genetic Resources Diversity: Wheat Productivity and Yield Stability in the Punjab of Pakistan" (Hartell)
- "Farmers' Seed Selection Practices and Maintenance of Landrace Characteristics in a Traditional Mexican Community" (Louette)
- "Agronomic and Economic Competitiveness of Landraces and *In Situ* Conservation in the Amecameca and Cuautla Valleys of Mexico" (Perales)
- "Can Improved Seed Selection Practices Help Farmers Maintain the Diversity of Their Maize: Evidence and Issues from the Sierra de Santa Marta, Mexico" (Rice)
- "Estimating the Economic Impact of Diversifying Genetic Resistance to Rust in Wheat" (Smale)
- "Who Is Bearing the Costs of Plant Genetic Resources Conservation?" (Virchow)

Depending on the availability of resources, a proceedings may be issued.

**4.2.2. The impact of genetic diversity on wheat crop productivity:
a comparative analysis of China and Australia**

Duration:

1997-1999

Objectives:

This project attempts to assess the extent of genetic diversity (spatial, temporal, pedigree, and intravarietal diversity) in wheat varieties in China and Australia and to quantify the impact of such diversity on productivity and stability of wheat production in each country.

Participants:

Economics Program staff (Melinda Smale, Erika Meng); Wheat Program staff (Bent Skovmand); NSW Department of Agriculture (John Brennan); University of Sydney,

Department of Agricultural Economics (David Godden); Chinese Academy of Agricultural Science (Jikun Huang); Stanford University (Scott Rozelle).

Activities:

- Further define what is meant by "genetic diversity in farmers' fields" and further develop diversity indices for wheat.
- Develop a database on wheat varieties that includes information on pedigrees, morphological and genealogical characteristics, yield, year of release, area planted to each variety over time, inputs used. These data are essential to the construction and interpretation of diversity indices.
- Quantify the relationship between genetic diversity and crop productivity/stability.
- Identify key policy options related to managing and maximizing the farm-level genetic diversity in wheat production systems.

Progress to Date:

Research delayed, pending arrival of Rockefeller Postdoctoral Fellow.

4.2.3. Costs of storage and maintenance of *ex situ* cereal germplasm

Duration:

1997-1998

Objectives:

Returns to germplasm stocks are widely acknowledged to be difficult to quantify, but identification of the order of magnitude of costs would be extremely useful in assessing the need for precise evaluation of benefits. For example, if the marginal costs of additions to germplasm stocks are sufficiently low, research to obtain more exact estimates of benefits might be unnecessary. If marginal costs of collecting and maintaining a large *ex situ* stock are more significant, further work to assess benefits may be important. Similarly, the evaluation of other decisions, such as regeneration frequencies, should start with an assessment of the marginal costs of such operations.

CIMMYT is collaborating with the University of California and IFPRI in a pilot project that is part of a larger study to assess the costs associated with *ex situ* germplasm operations of centers in the CGIAR. Typical *ex situ* germplasm operations encompass a range of activities, including:

- collection and acquisition;
- multiplication and regeneration;
- documentation and data management;
- conservation (and safety duplication);
- characterization;
- evaluation;
- distribution and exchange (quarantine);
- conservation research;
- utilization research and prebreeding;
- breeding.

The study will characterize the cost structures of these germplasm operations in ways that are useful for assessing their economic performance and then set about measuring these costs in a comparable fashion for some selected operations. The CIMMYT pilot project will focus initially on the wheat germplasm center at CIMMYT and probably will eventually include the maize germplasm work.

Participants:

IFPRI, CIMMYT (Economics, Maize, Wheat Programs), University of California staff.

Progress to Date:

A meeting was held in mid-1997 to plan data collection activities.

**4.2.4. Maize diversity management and utilization:
a farmer-scientist collaborative approach**

Duration:

1997-2000

Objective:

Assess whether farmers' management of maize diversity can be influenced through collaborative breeding, the provision of new skills, and the development or strengthening of social organizations so that household welfare (private benefits) can be increased while genetic diversity (private and public benefits) is maintained or enhanced.

Outputs of this work will include:

- Characterization of farmers' management of maize diversity in the central valleys of Oaxaca, Mexico.
- A better understanding of the factors that affect farmers' management of maize diversity and their mechanisms of action.
- Identification of groups of farmers that are homogeneous in terms of their management of diversity; clarification of the relationship of these groups to maize genetic diversity and socioeconomic factors.
- Identification of germplasm, skills, and information that breeders and social scientists can provide to enhance the contribution of farmers' management of diversity to household welfare and genetic diversity by group.
- Identification of social organizations to support the flow of germplasm, skills, and information and thereby sustain the flow of private and public benefits over time.

Participants:

CIMMYT, INIFAP, and other scientists.

Activities:

- Diagnostic survey with key informants about their management of maize diversity.
- Participant observation of seed stock management in selected communities.
- Analysis of farmers' evaluation of the maize populations in breeders' trials.
- On-farm random survey in selected communities to explore related exogenous socioeconomic, agroecological, and ethnic factors influencing farmers' management of diversity.
- Classification of farmers into homogenous groups in terms of their management of diversity.
- Development of theoretical and empirical models to relate exogenous socioeconomic, agroecological, and ethnic factors to farmers' management of diversity, and farmers' management of diversity to genetic diversity.

Progress to Date:

- Study communities in Oaxaca have been identified.
- Maize samples and farmers' perceptions associated with them have been collected.
- Farmers' perceptions of these maize samples are being analyzed.
- Initial conceptual framework has been developed.
- Detailed workplan has been developed for the first two years of the project.

5. Strengthening NARS Capacity

Contents

5.1	Strengthening NARS Capacity within the New CIMMYT Project Structure	
Projects		Status
5.2	Strengthening Economics and Policy Research in National Agricultural Research Systems (NARSs) in Eastern Africa	Current
5.3	Economic Analysis of Productivity-Enhancing, Resource-Conserving (PERC) Technologies (Latin America)	Current
5.4	Accelerating Adoption of New Technologies in Maize-Based Cropping Systems of Central America	Current

5.1. Strengthening NARS Capacity within the New CIMMYT Project Structure

<p>Economics Program research dedicated to strengthening NARSs capacity contributes to CIMMYT's overall goals for Global Project 8, "Building Partnerships through Human Resource Development"; Regional Project 1, "Improving Food Security in Sub-Saharan Africa"; and Regional Project 5, "Enhancing Maize and Wheat Production Systems in Latin America and the Caribbean," as follows (adapted from CIMMYT's Medium-Term Plan).</p>
<p>Building Partnerships through Human Resource Development</p>
<p>Objective:</p> <ul style="list-style-type: none"> • To improve the efficiency of research resources through human resource development and the enhancement of partnerships with NARSs.
<p>Problems Addressed:</p> <ul style="list-style-type: none"> • Limited preparation of agricultural scientists in some developing countries in theoretical and applied research methods, especially methods for conducting research on sustainable maize and wheat systems. • Limited access of NARS researchers to results of research on sustainable maize and wheat systems conducted in other countries or regions. • Limited access of NARS researchers to other kinds of scientific and policy information. • Limited opportunities for NARS researchers to interact professionally with colleagues in the global scientific community. • Ineffective linkage within NARS among disciplines, between research and extension, and among institutions, leading to inefficient use of available human resources in addressing priority problems.
<p>By the year 2000...</p> <ul style="list-style-type: none"> • At least 1000 NARS scientists will receive training by CIMMYT in areas of the Center's competence. • A similarly large number of NARS scientists will have worked as Visiting Scientists at CIMMYT, thereby improving their research skills. • Crop management research training for maize and wheat systems will be fully devolved to NARS-led regional training initiatives in Asia, Africa, and Latin America. • CIMMYT will have three years of experience in conducting its new sustainable systems training course, helping NARS scientists to become better aquatinted with the principles and practice of research on sustainable systems, and how research integration can serve this end. • Major NARS research partners will have measurably better access to international agricultural information networks, in part through CIMMYT-facilitated endeavors.
<p>Improving Food Security in Sub-Saharan Africa</p>
<p>Objective:</p> <ul style="list-style-type: none"> • To enhance food security through increased maize and wheat production and productivity in sub-Saharan Africa, while minimizing adverse impacts on the environment and the natural ecosystems.
<p>Problems Addressed:</p> <ul style="list-style-type: none"> • Low and unstable maize and wheat production in the face of rapidly increasing demand, resulting in inadequate food supplies, lack of food security, and the need to import grain or, in extreme cases, to depend on food aid. • Reduction in the quality of land and other resources, as a result of increasing population pressure, which leads rural inhabitants to bring more marginal lands under cultivation and ultimately increases rural poverty. • Lack of adequate human resources in the region to address priority food production and supply problems.

<ul style="list-style-type: none"> • Lack of appropriate policies regarding input distribution, pricing, and use.
<p>Anticipated Impacts</p> <ul style="list-style-type: none"> • An enhanced and stable supply of grain for food and feed, and reduced prices to consumers of maize and wheat products – both contributing to the well-being of rural and urban poor and to food security at the national and regional levels. • Reduced maize and wheat imports, with consequent benefits for national balances of trade and reduced dependence on international food aid. • Diminished environmental degradation, as a result of the more efficient use of land, water, and other inputs.
<p>Enhancing Maize and Wheat Production Systems in Latin America and the Caribbean</p>
<p>Objective:</p> <ul style="list-style-type: none"> • To increase the productivity and sustainability of maize- and wheat-based systems in Latin America and the Caribbean.
<p>Problems Addressed:</p> <ul style="list-style-type: none"> • Need for diagnostic information on maize and wheat production ecologies to help better define maize and wheat system productivity/sustainability problems (in terms of their processes, pace, incidence, causes and consequences), and to help identify areas of potential extrapolation for new technology. • Need for high-yielding maize and wheat cultivars suited to well-defined production ecologies and that feature, as needed, appropriate grain types, acid soil tolerance, tolerance to pests (including ear worm and armyworm) and diseases, suitability to associations with beans or cassava (maize) or to grazing and stover production systems (wheat). • Need for improved management practices that foster greater maize and wheat system productivity and sustainability, and that complement the advantages of improved germplasm; these practices may include conservation tillage, green manure cover crops, and improved crop residue management. • Need for information and analysis on policies and institutional arrangements (including seed industries) that affect farm-level adoption of new maize and wheat varieties and management practices.
<p>By the year 2000...</p> <ul style="list-style-type: none"> • A set of publications will be released describing factors governing adoption of improved maize and wheat germplasm, and relevant crop and system management practices. • An endeavor will be underway to inform the debate relative to policies and institutional arrangements that influence farmer adoption of maize and wheat germplasm and management practices.

5.2. Strengthening Economics and Policy Research in National Agricultural Research Systems (NARSs) in Eastern Africa

Duration:

1995-2000

Objective:

The goal of the project is to increase the productivity of agriculture in eastern Africa in an equitable and sustainable fashion. The specific objectives are:

1. to strengthen the priority-setting capacity of NARSs;
2. to strengthen interactions between NARSs and the policy arena; and
3. to strengthen interactions among NARS socioeconomists.

Participants:

Socioeconomists in NARSs in Ethiopia, Kenya, Tanzania, and Uganda.

Activities:

- National research.
- National networking.
- Regional training workshops.
- Regional networking.

Progress to Date:

• National research

Ethiopia

1. An assessment of farmers' seed sources and management in Chilalo Awraja.
2. Comparative assessment of combine harvesting vis-à-vis conventional harvesting and threshing of wheat in Gedeb and Etheya areas.
3. An assessment of farmers' seed sources and management in Wolmera woreda.
4. Gender analysis in agricultural production and decision-making process in Ada, Lume, and Gimbichu woredas.
5. Assessment of farmers' wheat seed sources and management in Goncha-Siso-Enebssie and Enebssie-Sar-Midir woredas, East Gojam.
6. An assessment of adoption of seed and fertilizer packages and the role of credit in smallholder maize production in Sidama and North Omo zone.
7. Study of the traditional mechanisms for maize seed diffusion in western Shewa and eastern Wellega zones of Oromia.
8. The effect of market liberalization on the supply and consumption of fertilizer in southeastern Ethiopia.

Kenya

1. An assessment of the adoption of seed and fertilizer packages and the role of credit in small-scale maize production in Kakamega and Vihiga Districts.
2. Economics of animal manure utilization versus chemical fertilizer by small-scale farmers in Kiambu District.
3. Wheat production and farmers' seed management in Kenya.
4. A survey of the seed industry in the semiarid region of Kenya.

Tanzania

1. An assessment of the impact of maize research in Tanzania.
2. Adoption of improved wheat technology by small-scale farmers in Tembela and Ilembo Divisions of Mbeya Region, Tanzania.

3. The economics of recycling hybrids and open-pollinated maize varieties in the low and midaltitude environments of Tanzania.

Uganda

1. An assessment of the factors affecting the adoption of maize production technologies in Uganda.
2. Gender analysis of agricultural production in maize-based farming systems in Iganga District of eastern Uganda.

- ***National networking***

Four national meetings for socioeconomists have been held, one each in Ethiopia, Kenya, Tanzania and Uganda.

- ***Regional training workshops***

Three regional training workshops have been held in the following areas:

- Natural Resources Policy Analysis (2)
- Seed Production and Supply Policy (1)

- ***Regional networking***

Two regional networking activities have been held for socioeconomists with research projects in the following areas:

- Gender analysis in agricultural production
- Adoption of agricultural technologies in maize- and wheat-based farming systems

For Further Information:

Project description and some preliminary research summarized in the CIMMYT 1996/97 *Annual Report* (forthcoming); in S. Bisanda and W. Mwangi, *Adoption of Recommended Maize Technologies in Mbeya Region of the Southern Highlands of Tanzania* (Addis Ababa, Ethiopia: CIMMYT and United Republic of Tanzania, Ministry of Agriculture, 1996); and in poster prepared for this External Review.

5.3. Economic Analysis of Productivity-Enhancing, Resource-Conserving (PERC) Technologies (Latin America)

Duration:
1993-1999

Objectives:

To evaluate the economic feasibility of introducing a PERC technology into different maize-based cropping systems.

The PRM (Programa Regional de Maíz/Regional Maize Program) has pursued two main lines of research on PERC technologies:

- crop residue management, often combined with reduced tillage; and
- incorporation of leguminous green manures in intercropping, relay cropping, or rotation into the system.

In particular, the project aims to understand the cost and benefits from the farmer's point of view of incorporating these types of technologies into their cropping system. The analysis incorporates short- and long-term effects, relevant interactions with the livestock subsystem, risk considerations, and the impact of different economic and institutional policies.

Participants:

CIMMYT, PRM, RCSE, IICA, national agricultural research systems, CIAT.

Activities:

- Economic analysis of selected PERC technologies using data from long-term trials.
- Studies to identify the profitability and compatibility of conservation tillage and green manure practices in different maize-based cropping systems.
- Studies to identify the main factors affecting farmers' adoption of green manure technologies featuring velvetbean.
- Building a conceptual framework to understand farmers' adoption and management of the technology.
- Building a conceptual model to determine the optimum management of the technology

Progress to Date:

Research results summarized in:

Sain, G., and H. Barreto. 1996. The adoption of soil conservation technology in El Salvador: Linking productivity and conservation. *Journal of Soil and Water Conservation* 51(4): 313-321 .

Sain, G. 1996. Tecnologías para conservación y productividad: sustitutas o complementarias. *Agronomía Mesoamericana* 7(2): 108-115.

Sain, G. and D. Buckles. 1997. *The Economics of the Abonera System*. Submitted for publication by CIMMYT.

5.4. Accelerating Adoption of New Technologies in Maize-based Cropping Systems of Central America

Duration:
1993-1999

Objectives:

To facilitate farmers' adoption of new technologies for maize-based systems in specific areas of Central America.

Specifically, the project aims to:

- Identify the main factors that influence farmers' adoption of new technologies.
- Identify implications for research and policy.
- Generate relevant information to stakeholders to improve the political and economic environment for farmers adoption of new technologies.

Participants:

CIMMYT, PRM, RCSE, IICA, NARSs, NGOs, PASOLAC.

Activities:

- Field studies (6) to identify the degree of adoption (diffusion) and the main factors influencing farmers' decision to adopt the new technologies.
- Market studies to identify the main constraints to adoption.
- Feedback workshops (3).
- Field activities (2).

Progress to Date:

- Sain, G., R. Tripp, and E. Brenes (eds.). 1994. *Desafíos presentes y futuros del medio ambiente y la productividad en la agroempresa Centroamericana*. San José, Costa Rica: INCAE.
- Sain, G., B. Miranda, J. Rivera y C. Choto (eds.). 1995. *Memoria del Taller de productividad y conservación de los recursos en la agricultura de laderas, San Salvador, 6-7 de Julio 1995*. San José, Costa Rica: CIMMYT, CENTA, INCAE, IICA.
- Choto C., T. Montenegro, y G. Sain. 1995. *Memoria de la I Feria de la labranza de conservación en Guaymango, El Salvador, 7 de Abril de 1995*. San José, Costa Rica: CENTA, CIMMYT, PRM.
- Sain, G., F. Herrera, y J. Martínez. 1996. *Adopción y uso de semilla mejorada de maíz entre pequeños agricultores de Guatemala*. Publicación técnica de Difusión del Programa Colaborativo ICTA-PRM-CIMMYT. San José, Costa Rica: ICTA, PRM, CIMMYT.
- Choto C., G. Sain y T. Montenegro. 1996. *Oferta y demanda de semilla mejorada de maíz en El Salvador*. Publicación técnica de Difusión del Programa Colaborativo CENTA-PRM-CIMMYT. San José, Costa Rica: CENTA, PRM, CIMMYT.
- Sain, G., A. Viana, J. Bolaños y J. Martínez (eds.). 1996. *Memoria del Seminario-Taller acciones para impulsar la adopción de semillas mejoradas de maíz y frijol, Guatemala, 28 de Junio de 1996*. San José, Costa Rica: ICTA, PRM, PROFRIJOL, CIMMYT.
- Pereira, A., G. Sain., y Y. Villareal. 1997. Adopción de la labranza de conservación en el cultivo de maíz en la región de Azuero, Panamá. 1994. In J. Bolaños (ed.), *Síntesis de resultados experimentales del PRM 1993 - 1995*. Guatemala, Guatemala: PRM.
- Sain, G., and J. Martinez. 1997. Adoption and use of improved maize seed by small farmers in southeast Guatemala. Submitted for publication as an Economics Working Paper.
- Sain, G., and M. López Pereira. 1997. Impacto de las políticas en la producción de maíz en Centro América y México. Paper presented at IFPRI Policy Workshop, Honduras.

6. **Future Facts and Trends Publications**

Background

Each issue of Facts and Trends requires: at least three person-months of headquarters senior staff time; considerable input from outreach staff (from all CIMMYT programs); a full-time research assistant for analysis and writing; considerable input from two other research assistants (database management, development of graphics); input from external and internal reviewers; and a significant effort from editing and production staff. Previously a report appeared each year; the reports focused on maize and wheat in alternate years. In 1995, CIMMYT decided to delay publication of the next report for one year because the Economics Program, with its limited staff resources, simply could not accommodate the regular publishing deadline. However, owing to considerable pressure from outside the Program, a preliminary report was issued in 1995, containing findings of the ongoing research that was eventually summarized fully in the 1996 *World Wheat Facts and Trends*. It would be helpful to avoid these sorts of irregularities in the future, as they place an unexpected burden on Economics staff.

Issues

Resources: What is the value of this publication? What is an appropriate level of resources for the Program to invest in this publication? What kind of publication schedule should be followed?

Content: Should we change the kind of information contained in the report? Should the report be smaller, simpler to produce? The debate continues to rage over whether this publication should be less technical, more technical, or remain the same.

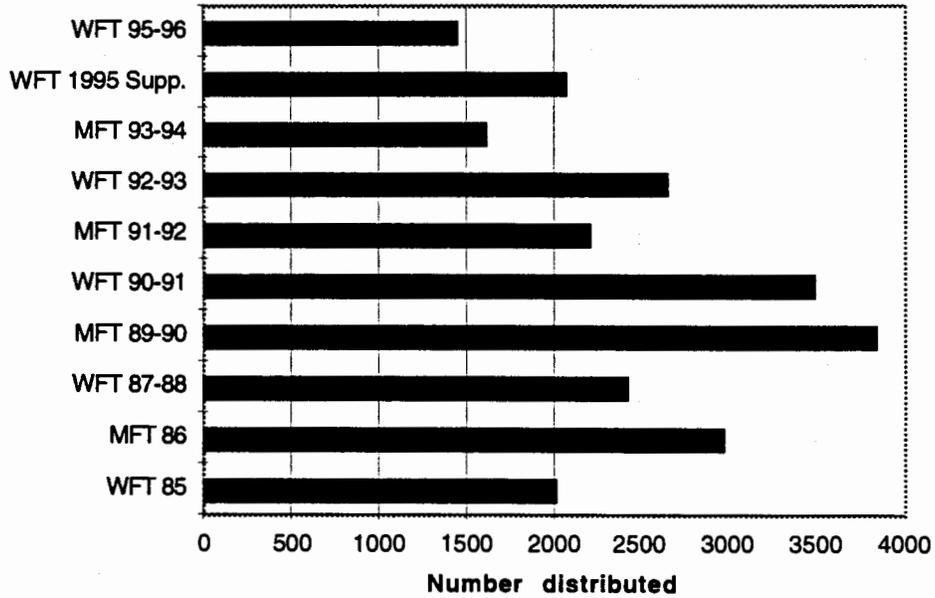
Is it meaningful to collect data on producer prices, etc., through key informants and "reliable contacts"? Is there a rational means of selecting themes for future reports?

Past themes have included:

- The Wheat Revolution Revisited: Recent Trends and Future Challenges (1987-88)
- Realizing the Potential of Maize in Sub-Saharan Africa (1989-90)
- Wheat and Barley Production in Rainfed Marginal Environments of the Developing World (1990-91)
- Maize Research Investment and Impacts in Developing Countries (1991-92)
- The Wheat Breeding Industry in Developing Countries: An Analysis of Investments and Impacts (1992-93)
- Maize Seed Industries, Revisited: Emerging Roles of the Public and Private Sectors (1993-94)
- Ongoing Research at CIMMYT: Understanding Wheat Genetic Diversity and International Flows of Genetic Resources (Supplement, 1995)
- Understanding Global Trends in the Use of Wheat Diversity and International Flows of Wheat Genetic Resources (1995-96)

Themes for future reports have been suggested (maize should be covered next):

- Future maize technology needs in drought-prone areas of Sub-Saharan Africa.
- Breaking the yield barrier in wheat -- technologies for enhancing and sustaining growing in productivity.
- Breaking the yield barrier in maize -- technologies for enhancing and sustaining growing in productivity.
- Update on maize utilization in developing countries, featuring food versus feed comparisons by region and income class grouping. A sidebar will provide information on the white maize economy.



Distribution of Facts and Trends Publications, 1985-96

7.
Economics Program Staff, June 1997

NAME	TITLE	CITIZENSHIP	BASE
Staff			
Prabhu L. Pingali	Director	India	Mexico
Mauricio Bellon	Senior Human Ecologist	Mexico	Mexico
Paul Heisey	Senior Economist	USA	Mexico
Damien Jourdain	Predoctoral Fellow	France	Mexico
Erika Meng	Rockefeller Foundation Visiting Research Fellow	USA	Mexico
Michael Morris	Senior Economist	USA	Mexico
Mulugetta Mekuria	Economist, Southern Africa	Ethiopia	Harare
Wilfred Mwangi	Principal Economist, Eastern Africa	Kenya	Ethiopia
Gustavo Sain	Senior Economist, Central America	Argentina	Costa Rica
Melinda Smale	Senior Economist	USA	Mexico
Hugo Verkuijl	Associate Economist	Netherlands	Ethiopia
Monika Zurek	Predoctoral Fellow	Germany	Costa Rica
Under recruitment	Economist, Latin America	..	Mexico
Under recruitment	Postdoctoral Fellow	..	Mexico
Research Associates			
Maximina Lantican	Research Associate	Philippines	Mexico
Naresh Pradhan	Research Associate	Nepal	Mexico
Manisha Shah	Research Associate	USA	Mexico
Affiliate Scientists			
John Brennan	Affiliate Scientist	Australia	NSW Dept. of Agriculture
David Cleveland	Affiliate Scientist	USA	University of California
Cheryl Doss	Affiliate Scientist	USA	Williams College
David Godden	Affiliate Scientist	Australia	University of Sydney NSW
Douglas Gollin	Affiliate Scientist	USA	Williams College
Jikun Huang	Affiliate Scientist	China	CAAS
Miguel López-Pereira	Affiliate Scientist	Honduras	Honduras
Dominique Louette	Affiliate Scientist	France	Mexico
Jim MacMillan	Affiliate Scientist	Canada	Manitoba University (on sabbatical, based in Mexico)
Scott Rozelle	Affiliate Scientist	USA	Stanford University
Greg Traxler	Affiliate Scientist	USA	Auburn University
Marianne van Dorp	Affiliate Scientist	Netherlands	Mexico
Ph.D. Students			
Alfonso Aguirre	Ph.D. student	Mexico	UNAM
Nazmul Chaudhury	Ph.D. student	Nepal	Michigan State University
Daniela Soleri	Ph.D. student	USA	University of Arizona

Allocation of Economics Staff Time, by CIMMYT Project

Project		Time allocation (%) by researcher											Person-years
		Bellon	Heisey	Mekuria	Meng	Morris	Mwangi	Pingali	Sain	Smale	Verkuijl	Latin American Economist	
Global Projects													
G1	Conservation and management of genetic resources	30	50	40	1.2
G2	Developing core germplasm and integrating interdisciplinary approaches for the improvement of maize	10	0.1
G3	Developing core germplasm and integrating interdisciplinary approaches for the improvement of wheat	10	0.1
G4	Increasing maize productivity and sustainability in stressed environments: abiotic and biotic stress
G5	Increasing wheat productivity and sustainability in stressed environments: abiotic stress
G6	Increasing wheat productivity and sustainability in stressed environments: biotic stress
G7	Gauging the productivity, equity, and environmental of modern maize and wheat production systems	20	50	30	20	40	20	30	20	30	20	30	3.1
G8	Building partnerships through human resource development	40	20	..	20	..	20	..	1.0
Regional Projects													
R1	Improving food security in Africa through productivity improvements in maize and wheat	C	20	30	40	40	..	1.3
R2	Meeting the accelerating demand for maize development, production, and delivery in South and Southeast Asia and China	20	..	10	0.3
R3	Sustainable wheat production systems in the Indo-Gangetic Plains and China	C	10	0.1
R4	Increasing maize and wheat production in West Asia and North Africa	30	0.3
R5	Enhancing Latin American maize and wheat production systems	20	30	40	0.9
Frontier Projects													
F1	Raising the yield potential of wheat
F2	Apomixis: Equity in access to hybrid vigor for resource-poor farmers	C
F3	Using genetic engineering to improve the tolerance to biotic and abiotic stresses in maize and wheat
F4	Improving human nutrition by enhancing bio-available protein and micronutrient concentrations in maize, wheat, and triticale	..	C
F5	Genetic approaches to reducing post-harvest losses
F6	Priority setting and technology forecasting for increased research efficiency	..	30	40	20	30	..	30	20	30	2.0
F7	Learning to more efficiently confront problems of resource degradation in maize and wheat systems	30	30	0.6
Special Focus Project													
S1	Wheat germplasm development in the Newly Independent States
Totals		100	100	100	100	100	100	100	100	100	100	100	11.0

Note: C = consulting role.

Economics Program Staff

Biodata

VITA

MAURICIO RAFAEL BELLON

Education

Ph.D., Ecology, University of California, Davis, 1990

M.S., Ecology, University of California, Davis, 1987

Ingeniero Agrónomo, Universidad Autónoma Metropolitana, Mexico, D. F., 1984

Professional Experience

Present

Senior Human Ecologist, Economics Program, International Maize and Wheat Improvement Center (CIMMYT), Mexico. Responsible for participatory research, gender research, and jointly responsible for the human aspects of crop biodiversity research.

3/1995 - 2/1997

Affiliate Scientist, International Rice Research Institute (IRRI) Genetic Resources Center. Developed and analyzed results of research in three Asian countries to (1) understand, from a social science perspective, farmers' role in the use and conservation of rice genetic resources and (2) to identify opportunities to involve farmers in the conservation of the rice gene pool.

5/1994

Consultant, International Plant Genetic Resources Institute (IPGRI), Rome, Italy. Reported on key issues for decision makers regarding plant genetic resources, the Convention of Biological Diversity, and Agenda 21.

1993-94

Consultant, Centro de Ecología, Universidad Nacional Autónoma de México (UNAM). Developed the socioeconomic aspects of environmental impact assessment studies of several highways in Mexico. Evaluated the socioeconomic impacts of tree plantation in southeastern Mexico.

11/1991 - 1/1992

Consultant, Organization of American States, Mexico. Under a regional planning project, developed a report on organic farming in Los Cabos, Baja California, Mexico. Assisted the project team leader to develop a simulation model to assess impacts of development on the environment in the region.

2/1991 - 6/1991

Consultant, Centro de Investigación en Energía y Desarrollo A.C., Mexico City. Coordinated and carried out the agricultural portion of a diagnostic study for the sustainable development of the Cañadas region, Chiapas, Mexico.

1/1991 - 2/1992

Consultant, Consultores en Decisiones Gubernamentales, Mexico. Developed a report on Mexican organic farming and its export potential. Provided expertise on different aspects of agricultural, environmental, and forestry policies.

- 11/1990 - 2/1996** **Investigador Asociado C**, Universidad Nacional Autónoma México, Centro de Ecología. Research on the use and management of maize infraspecific diversity by small farmers, the role of maize and soils folk taxonomies in farmers' decision-making, the adoption of integrated pest management, and the human ecology aspects of forest management. Designed and taught courses on human ecology; ecology and economics; and field methods in socioeconomic analysis.
- 3/1989 - 7/1990** **Research Assistant**, University of California, Davis, Department of Applied Behavioral Sciences. Assisted in the analysis of data on biological diversity of potatoes in Peru; coauthor of resulting article.
- 1/1994 - 8/1994** **Consultant**, Hoechst S. A. de México. Developed a database on experiments done by Mexican research institutions using Hoechst products.
- 1982** **Analyst**, Instituto Mexicano de Comercio Exterior. Two diagnostic studies on the production and marketing of Mexican essential lime oil and mangoes.

Honors and Awards

National Researcher Level I, Mexican government recognition and grant (1995-96); Candidate for National Researcher, Mexican government recognition and grant (1992-95); National Science Foundation Dissertation Research Award (1988-90); InterAmerican Foundation Doctoral Fellowship (1988-89); Doctoral Fellowship, Consejo Nacional de Ciencia y Tecnología, Mexico (1984-89); Honorable Mention, Annual R. Merton Love student seminar competition in ecology and evolutionary research, University of California, Davis (1990).

VITA

PAUL W. HEISEY

Education

Ph.D., Agricultural Economics, University of Wisconsin, Madison, Wisconsin, 1985
M.A., Agricultural Economics, University of Wisconsin, Madison, Wisconsin, 1979
B.A., Mathematics, Messiah College, Grantham, Pennsylvania, 1970

Professional Experience

- Present** **Senior Economist**, Economics Program, International Maize and Wheat Improvement Center (CIMMYT), Mexico. Work in the areas of impact assessment; technology forecasting and priority setting; and economics of technological change in cereals in sub-Saharan Africa. Contribute to research on seed industries and the economics of genetic diversity.
- 7/1993 - 5/1994** **Study Leave**, Department of Agricultural and Applied Economics, University of Minnesota.
- 7/1989 - 6/1993** **Regional Economist**, Southern Africa, CIMMYT, based in Malawi. Provided economic analysis of both breeding strategies and crop management research in maize to CIMMYT and Malawi Department of Agricultural Research; collaborated in the study of technological change in maize production in the region, with emphasis on Malawi; taught on-farm research techniques, evaluation of on-farm trials, statistics, survey analysis, and policy analysis to social and agricultural scientists in Southern and Eastern Africa.
- 1/1988 - 6/1989** **Consultant**, Economics Program, CIMMYT. Edited research report on post-Green Revolution diffusion of wheat varieties in Pakistan. Taught economics and statistics to social and agricultural scientists in Southern and Eastern Africa, and Pakistan.
- 7/1988** **Consultant**, US Agency for International Development. Participated in evaluation of international wheat breeding program based at Oregon State University.
- 1/1987 - 12/1987** **Associate Scientist**, Economics Program, CIMMYT.
- 9/1985 - 12/1986** **Post-Doctoral Fellow**, Economics Program, CIMMYT, based in Pakistan. Advised and trained social and agricultural scientists, Pakistan Agricultural Research Council, in economics and statistics; conducted research on post-Green Revolution wheat varietal turnover; economic response to fertilizer; higher-altitude maize-based farming systems.

- Fall 1983** Prepared graduate level bibliography for University of Wisconsin Department of Agricultural Economics. Subject: application of microeconomic analysis to agriculture in less developed countries.
- 10/1980 - 8/1981**
1/1982 - 4/1982 Field dissertation research, Gaborone, Botswana and Mmphashalala village, Botswana.
- 9/1981 - 12/1981** Prepared report for Southern District, Botswana, planning personnel in Southern District Communal First Development Area.
- Fall 1977-Sum. 1978** Conducted bibliographic research, reviewed project proposals for University of Wisconsin Land Tenure Center African Research Study Committee.
- Spr. - Sum. 1977** Conducted bibliographic research, served as teaching assistant, and served as seminar reporter for Land Tenure Center course and seminar on Agrarian Reform and Institutional Innovation.
- Sum. - Fall 1976** Coded questionnaires for study of off-farm employment by members of Wisconsin farm families; coded questionnaires for Wisconsin Farm Transfer and Enlargement Study.
- 1970-73** Taught secondary school mathematics at Kuru Government Secondary School, Bukuru, Nigeria under Mennonite Central Committee Teachers Abroad Program.

Honors and Awards

Outstanding Dissertation Award, University of Wisconsin Department of Agricultural Economics (1985); Social Science Research Council (U.S.) Dissertation Fellowship (1980-82); University Fellowship, University of Wisconsin (1978-79); WARF Fellowship, University of Wisconsin (1975-76); B.A. *Magna Cum Laude*; National Merit Scholarship (Shell Corp.) (1966-70); High School Valedictorian.

Professional Memberships

American Agricultural Economics Association; American Economics Association; Phi Kappa Phi; Gamma Sigma Delta.

VITA

MAXIMINA ALVAREZ LANTICAN

Education

M.S., Agricultural Economics, University of the Philippines, Los Baños, 1988

B.S., Agriculture, University of the Philippines, Los Baños, 1977

Professional Experience

- Present** **Research Associate**, Economics Program, International Maize and Wheat Improvement Center (CIMMYT), Mexico.
- 1982-97** **Economist, Senior Researcher**, International Rice Research Institute (IRRI), Soil and Water Sciences Division, Philippines. Prepared research proposals and conducted socioeconomics research; monitored status of projects, supervised all project staff; evaluated projects; analyzed and interpreted research findings; produced reports. Under one project, assessed the impact of soil erosion from the upper watershed (due to intensive cropping) on productivity of irrigated lowlands.
- Economist-coordinator/trainer**, Thailand (1994); Philippines (1990-93). Organized, coordinated, and implemented the Irrigation Water Management Course. Lectured on socioeconomic problem identification and evaluation.
- Economist/trainer**, Indonesia (1988). Trained research and field staff of Sukamandi Research Institute for Food Crops on socioeconomics research methods. Supervised staff in implementing collaborative research project in Cirebon, West Java.
- 1978-81** **Project Officer**, Farm Systems Development Corporation, Economics Unit, Philippines. Coordinated and implemented Farming Systems Optimization Model project in Central and Western Visayas. Monitored and evaluated project.
- 1977** **Research Assistant**, Department of Social Sciences, University of the Philippines, Los Baños, Philippines. Conducted impact study of the government's Masagana-99 program in Nueva Ecija and Bulacan Provinces.

Honors and Awards

IRRI Scholar (1986-88); valedictorian, graduating class (1972); Gerry Roxas Leadership Award (1972); Insular Life Gold Eagle Award (1972)

Professional Memberships

Philippine Agricultural Economics and Development Association; Federation of Crop Science Societies of the Philippines; University of the Philippines Alumni Association.

VITA

MULUGETTA MEKURIA

Education

Ph.D., Agricultural Economics, Michigan State University, East Lansing, Michigan, 1994
M.Sc., Agricultural Economics, University of Wales, Aberystwyth, Wales, 1981
B.Sc., Agriculture, Addis Ababa University, Alemaya College of Agriculture, Ethiopia, 1977

Professional Experience

- Present** **Economist, Southern Africa, Economics Program, International Maize and Wheat Improvement Center (CIMMYT), to be based in Zimbabwe.**
- 1996-97** **Vice-Dean, Faculty of Agriculture, University of the North, South Africa (1996-97). Research facilitator, Faculty of Agriculture, and Member of the Central Research Committee, University of the North. Leader, analysis of technology adoption by small-scale and emerging commercial farmers, Northern Province, South Africa.**
- 1994-97** **Head and Senior Lecturer, Department of Agricultural Economics, University of the North. Responsible for undergraduate and postgraduate course. Leader of food security research, Land Management and Rural Development Project (EU funding), 1995-97.**
- 1992-93** **Graduate Assistant, Department of Agricultural Economics, Michigan State University, East Lansing, Michigan.**
- 1982-85** **Lecturer (seconded from IAR), Alemaya University of Agriculture, Alemaya, Ethiopia. Taught fourth-year courses in agricultural development policy, research methods in agricultural economics, and farming systems research.**
- 1981-88** **Head, Department of Agricultural Economics, National Institute of Agricultural Research (IAR), Ethiopia. Responsible for the design and execution of research projects; managed a professional staff of 15-20 Agricultural Economists assigned to eight regional research centers. National Coordinator and Farming Systems Research Project Leader (project funded by IDRC, World Bank), 1985-88; responsible for project preparation, negotiations, appraisal, implementation, and reporting. Member, IAR, and Alemaya University of Agriculture Collaborative Research Advisory Committee, 1987-88. Secretary, National Research Extension Liaison Committee, Joint Working Task Force of IAR-Ministry of Agriculture, 1984-88.**
- 1981-83** **Research Officer, IAR. Participated in research projects; prepared project proposals for funding.**

1977-81

Assistant Research Officer, IAR. Conducted farm management surveys throughout Ethiopia.

Other Professional Activities

Member, National Technical Committee on Price Policy (1986-88); Team Leader, IAR Manpower Development Task Force (1985-88); Expert Consultant, IGADD, On-Farm Research Methods for Drought Affected Areas of IGADD Member States (1988); Member, UNDP-FAO-Government of Ethiopia review mission for UNDP Country Project IV (1987); Member, ISNAR-IAR Review Team on Agricultural Research Organization in Ethiopia (1987); Member, Joint Coordination Committee, IAR, and Ministries of State Farms Development and Coffee and Tea Development (1986-88); Member, National Variety Release and Review Committee (1984-88); Member, World Bank Agricultural Research Project Appraisal Team (1982-84);

Honors and Awards

Rockefeller Foundation grant for 22nd Conference of International Agricultural Economists (1994); Institutional Related Fellowship Award, IDRC, Canada (1988-93); IDRC/CIMMYT Visiting Scientist Grant (1985); IDRC Visiting Scientist Grant (1983); FAO Fellowship (1979-81); Editorial Board Member and Executive Secretary, *Ethiopian Journal of Agricultural Sciences* (1982-88); Chair, Publications Committee, IAR (1985-88); Chairperson, South African Society of Agricultural Economics, Interim Committee, Northern Province Branch, 1996-present).

Professional Memberships

International Association of Agricultural Economists; American Association of Agricultural Economists; South African Society of Agricultural Economics; Eastern and Southern Africa Association of Agricultural Economics; Agricultural Economics Society of Ethiopia.

VITA

ERIKA C.H. MENG

Education

Ph.D., Agricultural and Resource Economics, University of California, Davis (expected 1997)

B.A., Political Science and International Relations, *Magna Cum Laude*, University of Pennsylvania, Philadelphia, Pennsylvania, 1986

Professional Experience

- Present** **Rockefeller Foundation Visiting Research Fellow**, Economics Program, International Maize and Wheat Improvement Center, Mexico. (Pending completion of dissertation.)
- 1992-97** **Research Assistant**, University of California, Davis. Assisted in the conceptualization and estimation of a model to value the contribution of foreign genetic resources to U.S. wheat production with focus on both yield and quality characteristics. Researched and developed methodology incorporating wheat variety pedigrees for use in hedonic analysis of characteristics. Developed countrywide database of experimental and actual production characteristics.
- 1991-92** **Teaching Assistant**, University of California, Davis.
- 1988-90** **International Affairs Specialist**, U.S. Department of Agriculture, Office of International Cooperation and Development. Managed office bilateral scientific and technological cooperation and development programs between USDA and China, Thailand, and South Korea. Developed and implemented program activities for each country. Organized working groups with foreign representatives; evaluated U.S. and foreign proposals; negotiated cofinancing arrangements with other U.S. agencies. Prepared briefing and issue papers for policy makers; represented agency at interdepartmental meetings.
- 12/1985-12/86** **Public Relations Representative/Office Manager**, Westinghouse Electric Corporation (China), S.A., Shanghai, China. Managed daily and financial operations of representative office. Acted a liaison between corporation personnel and Chinese government officials and participated in joint venture and technology transfer negotiations.
- 8/1985-6/1986** **English Teacher**, Shanghai Jiao Tong University, Shanghai, China. Designed department curriculum and prepared teaching materials for conversational English.

Honors and Awards

Rockefeller Foundation Visiting Research Fellow; Patricia Roberts Harris Fellowship (1990-93); Jastro-Shields Research Grant (1994); Phi Beta Kappa, University of Pennsylvania (1986).

Professional Membership

American Agricultural Economics Association.

VITA

MICHAEL L. MORRIS

Education

Ph.D., Agricultural Economics, Michigan State University, East Lansing, Michigan, 1986
M.Sc., Agricultural Economics, Michigan State University, East Lansing, Michigan, 1983
B.A., Anthropology, Amherst College, Amherst, Massachusetts *Magna Cum Laude*, 1977
St. Albans School, Washington, D.C., *Cum Laude*, 1973

Professional Experience

- Present** **Senior Economist**, Economics Program, International Maize and Wheat Improvement Center (CIMMYT), Mexico. Principal activities include: conducting research related to wheat and maize technology forecasting and assessment, research impacts, and research priority-setting; generating information and analysis for use by CIMMYT management and scientific staff; providing support to national agricultural research systems; and participating in CIMMYT training activities.
- 9/1995 - 9/1996** **Visiting Researcher**, International Food Policy Research Institute (IFPRI), Washington, DC. Took study leave at IFPRI. Principal activity: producing an edited book about maize seed industries in the developing world.
- 1/1993 - 8/1995** **Regional Economist**, Asia, CIMMYT Economics Program, Bangkok, Thailand. Conducted research related to wheat and maize policy, commodity sector analysis, and distributional impacts of technological change; provided technical support to collaborators in national agricultural research systems; managed the CIMMYT Economics Program's Asia Regional Office.
- 1/1988 - 1/1993** **Economist**, CIMMYT Economics Program, Mexico. Conducted research related to wheat and maize policy, commodity sector analysis, and distributional impacts of technological change; managed CIMMYT Economics Program data base; coordinated *World Facts and Trends* publication series.
- 1/1987 - 1/1988** **Economist - Associate Scientist**, CIMMYT Economics Program, Mexico. Participated in research and training activities of the CIMMYT Economics Program. Research emphases included a case study involving domestic resource cost (DRC) analysis of wheat policy options in Zimbabwe and research resource allocation policy.
- 2/1984 - 10/1985** **Research Associate**, Michigan State University-Senegal Agricultural Research and Planning Project, Saint Louis, Senegal. Studied cereals markets in the Senegal River Valley under a project designed to strengthen the Institut Senegalais de

Recherches Agricoles. Conducted field research, performed data analysis, published policy-oriented working papers, presented findings to Senegalese policy makers.

6/1981 - 9/1981

Research Associate, World Bank, Washington, D.C. Studied the World Bank's experience in predicting rates of farmer adoption of new technologies.

12/1977 - 1/1980

Agricultural Extension Agent, ACTION/Peace Corps, Sierra Leone. Assigned to the Ministry of Agriculture and Forestry, with responsibilities in the CRS Small Farmers Project. Work activities included: recruiting project farmers, designing water control systems, constructing water control systems, teaching farmers improved practices for the cultivation of irrigated rice, assisting farmers' organizations.

Honors and Awards

Phi Kappa Phi Honors Society, Michigan State University, 1982; Amherst Memorial Fellowship, Amherst College, 1981/82, 1980/81; Phi Beta Kappa Honors Society, Amherst College, 1977.

VITA

W.M. MWANGI

Education

Ph.D., Agricultural Economics, Michigan State University, East Lansing, Michigan, 1978

M.A., Economics, Michigan State University, 1975

Diploma, Economics, Economics Institute, University of Colorado, Boulder, Colorado, 1973

B.A., Economics and Rural Economy, Makerere University, Kampala, Uganda, Upper Second Class Honors, 1972

Professional Experience

- Present** **Principal Economist and Liaison Officer, Eastern Africa, Economics Program, International Maize and Wheat Improvement Center (CIMMYT), Ethiopia.** Responsibilities include all administrative and financial matters for CIMMYT's regional office.
- 11/1987 - 12/1996** **Regional Economist, Eastern Africa and Liaison Officer, CIMMYT, Addis Ababa, Ethiopia.**
- 11/1986 - 10/1991** **Associate Professor, Agricultural Economics, University of Nairobi, Kenya.**
- 5/1981 - 10/1987** **Chairman, Department of Agricultural Economics, University of Nairobi.**
- 10/1979 - 11/1986** **Senior Lecturer, Agricultural Economics, University of Nairobi, Kenya.**
- 7/1978 - 10/1979** **Lecturer, Agricultural Economics, University of Nairobi, Kenya.**

Other Professional Activities

Chairman, Finance and Administrative Committee of the Board of Kenya Agricultural Research Institute (KARI) (1986-87). Member of the Board of Management of Kenya Agricultural Research Institute (KARI), appointed by the Minister of Agriculture (1986-87). External Examiner, University of Dar-Es-Salaam (1985), University of Swaziland (1985-86), University of Zambia, 1985-86), University of Zimbabwe (1984-86), Bunda College, University of Malawi (1984-86). Member of the Presidential Task Force on Divestiture of Government Investments, Appointed by His Excellency, the President of the Republic of Kenya (1983-86). Member, Board of Governors of Ichichi Secondary School, Appointed by the Minister of Education (1984-87). Appointed Regional Editor for Africa by the International Association of Agricultural Economists (IAAE) Executive Committee of *Agricultural Economics: The Journal of the IAAE* (1992-95). Appointed by the President of IAAE to represent Africa on the Nominating Committee of this Association, 1981-85. Elected Vice President (Administration), IAAE (1985-88).

Awards and Honors

Fellow, Salzburg Seminar, 1983; Kellogg Foundation Golden Anniversary Travel Fellow, 1979; Overseas Liaison Committee on Higher Education - Fellow, 1975; Afgrad Fellow,

1973-78; Mitchell Hall - Order of the Boot, Makerere University, 1972; Mitchell Hall - Certificate of Merit, Makerere University, 1972; Commonwealth Development Corporation Outstanding Student, 1968.

Professional Memberships

East African Agricultural Economics Society; Kenya Association of Agricultural Economists; International Association for Agricultural Economists; Society for International Development; Agricultural Society of Kenya.

VITA

PRABHU L. PINGALI

Education

Ph.D., Economics, North Carolina State University, Raleigh, North Carolina, 1982
M.A. (Hons.), Economics (5-year program), Birla Institute of Technology and Science, Rajasthan, India, 1977

Professional Experience

Present

Director, Economics Program, International Maize and Wheat Improvement Center (CIMMYT), Mexico. Lead a group of 10 economists primarily concerned with evaluating the impact, *ex ante* and *ex post*, of modern maize and wheat technologies; setting research priorities; identifying the interface between technology, policy, and the environment; and helping strengthen economics research capacity in developing countries, particularly in Africa and Latin America. Also member of the Center's senior management team, which is responsible for all research management and coordination issues.

5/1991 - 6/1996

Program Leader and Agricultural Economist, Irrigated Rice Ecosystems Program, International Rice Research Institute (IRRI), Philippines. Directed multidisciplinary research program focused on enhancing the productivity and sustainability of the irrigated lowland rice ecosystem. Coordinated IRRI's input in the CGIAR Systemwide initiatives on Rice-Wheat Systems Research in South Asia and Water Management Research for Asia. Also conducted research on the impact of modern technology on the environment and natural resource base and on the productivity impact of policy reforms in Indo-China and Myanmar. Coordinated IDRC project, "Strengthening Agricultural Economics Research Capacity in Vietnam."

5/1994 - 8/1994

Visiting Scholar, Stanford University, Food Research Institute, Philippines. Completed book on the productivity and sustainability of Asian rice systems.

4/1987 - 4/1991

Agricultural Economist, IRRI, Philippines. Coordinated research on economics of sustainable agriculture, focusing on technology and policy options for minimizing pesticide use for rice. Conducted research on the environmental and health impact of chemical input use in irrigated rice farming (funded by Rockefeller Foundation), which measured farm-level impacts of pesticide use on farmers and the paddy environment and quantified the "true" costs to farmers' of using pesticides. Coordinated an IDRC-funded research project on Asian farmers' response to low rice prices. Assessed rice research priorities for rapid production growth in Vietnam, Kampuchea, and Laos to design long-term research projects in these countries. Participated in a multidisciplinary farming systems

research team working on *ex ante* evaluation of pest management and soil fertility management technologies.

1987-97

Affiliate Associate Professor, University of the Philippines at Los Baños (concurrent appointment with IRRI appointment). Thesis supervision and team teaching of graduate courses.

9/1982 - 3/1987

Economist (Consultant), World Bank, Washington, D.C., Agriculture and Rural Development Department. Conducted research on agricultural mechanization and the evolution of farming systems in Sub-Saharan Africa. Organized research on crop-livestock systems in Sub-Saharan Africa to examine environments in which the integration of crop and livestock production is profitable.

8/1980 - 7/1982

Researcher, Department of Economics and Business, North Carolina State University, Raleigh, N.C. Collected/analyzed production information from 47 randomly selected orchards in North Carolina to elicit sample farmers' subjective probability estimates of crop damage from pests and weather; determine the relationship between human capital and farmers' errors in assessing crop damage; and examine the effect of errors in probability estimates on pest control input demand.

5/1976 - 8/1976

Researcher, International Crop Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad, India. Summarized the relationship between farm size and productivity in Indian agriculture.

Other Professional Activities

Member of International Advisory Board for the China Center for Agricultural Economics and Policy, Beijing, China (1977); Member of Steering Committee for the CGIAR Systemwide Initiative on Water Resources Management (1995-96); Chairman, Advisory Group for the Asian Crop and Resource Management Network (1994-96); Member of the Expert Consultation on the Sustainability of Rice-Wheat Production Systems in Asia, FAO Regional Office for Asia and the Pacific (1993); Member of External Review team of FAO's Production Economics and Farm Management Program (1989); Member of the Expert Consultation on Population, Agricultural and Rural Development: Institutions and Policy (1987); Consultant to the Global Perspective Unit of FAO (1986); reviewed the work on power requirements for the year 2000, for the Report on Agriculture in the Year 2000 (revised version); Member of the Expert Consultation on Population Growth and Economic Development, organized at Woods Hole, Massachusetts by the National Academy of Sciences, Committee on Population (1984).

Honors and Awards

1995 Policy Article Prize from the Center for International Food and Agricultural Policy at the University of Minnesota (1995); Outstanding Journal Article of the Year (Honorable Mention) from the American Agricultural Economics Association (1995); M.S. Swaminathan Award for Social Science Research and Development (1993); Research Discovery Award from the American Agricultural Economics Association (1988).

VITA

NARESH C. PRADHAN

Education

Ph.D., Agricultural/Resource Economics, University of Hawaii, Manoa, 1997
M.S., Agricultural Economics, University of the Philippines at Los Baños, Philippines, 1994
M.P.A., Tribhuvan University, Nepal, 1996
B.Sc., Agriculture, Tribhuvan University, Nepal, 1986

Professional Experience

Present	Research Associate , Economics Program, International Maize and Wheat Improvement Center (CIMMYT), Mexico.
8/1995-97	Agricultural Economist , Planning Division, Ministry of Agriculture, Kathmandu, Nepal. Planned, monitored, and evaluated Nepal's agriculture programs; assisted secretaries and ministers on agricultural policy matters; served as desk officer of multilateral and bilateral foreign-funded agricultural projects.
1/1995-7/1995	Planning Officer , District Agriculture Development Office, Makawanpur, Nepal. Planned, monitored, and evaluated the district-level agricultural development program of the Department of Agriculture.
1/1991-12/1994	Statistician/Agricultural Economist , Department of Soil Conservation and Watershed Management, Kathmandu, Nepal. Planned, monitored, and evaluated the national soil conservation and watershed management programs/projects.
9/1987-12/1990	Agricultural/Social Scientist , International Irrigation Management Institute (IIMI), Kathmandu, Nepal. Participated in research program funded by Ford Foundation to assist hill farmer-managed irrigation in Nepal. Implemented an assistance program for the farmer-managed irrigation scheme; organized water users' associations; facilitated farmer training on irrigation management; monitored and documented research activities; coordinated local consultants.
7/1986-8/1987	Research Assistant , IIMI, Kathmandu, Nepal. Assisted doctoral candidate with dissertation research on property structure, resource mobilization, and state intervention in the hill irrigation systems of Nepal.
5/1985-8/1985	Research Assistant . Assisted doctoral candidate with dissertation research for agricultural economics degree.

Other Professional Activities

Consultant, Integrated Consultancy Services (1996); Institutional Development Specialist/Economist to Consolidated Management Services, Kathmandu, for preparing World Bank project on Nepal's irrigation sector (1995); Benefit Monitoring and Impact Evaluation Specialist/Team Leader, Nepal-U.S. Agency for International Development irrigation management project (1995); Consultant, Hydro Engineering Services, to conduct a water use inventory of Kaski District (1990); Resource Person, Indiana University, for preparation of Nepal Irrigation Database (1990); Resource Person, several organizations working on irrigation studies in Nepal (e.g., International Labour Organization, IIMI).

Honors and Awards

Graduate Assistantship, University of Hawaii, Manoa (1996); Winrock Fellow (1992-94); Affiliate Research Scholar, International Rice Research Institute (1993-94); Research Fellow, IIMI (1993-94); Student Affiliate, East-West Center, University of Hawaii (1996).

VITA

GUSTAVO EDUARDO SAIN

Education

Ph.D., Agricultural Economics, University of California, Davis, 1980
M.S., Agricultural Economics, University of California, Davis, 1978
B.S., Universidad Católica de Mar del Plata, Balcarce, Argentina, 1970

Professional Experience

- Present** **Senior Economist, Central America, Economics Program, International Maize and Wheat Improvement Center (CIMMYT), Costa Rica.** Administrative and research management of two regional research networks; contribute to the institutionalization of both networks; conduct *ex ante* and *ex post* economic evaluations of technological change to identify and evaluate sustainable maize-based production practices for hillside agriculture; develop and test training materials and methodology for on-farm research economic analysis of experimental results and adoption studies; train national program researchers in the use of the methodologies.
- 1985-88** **Research and Training Officer, Central America and the Caribbean, CIMMYT Economics Program; based in Mexico (1985-87) and in San José, Costa Rica (1987-88).** Developed and tested training materials and methodology for on-farm research and economic analysis training courses; conducted research on policy analysis, on-farm research, and *ex ante* economic analysis of experimental results.
- 1983-84** **Post-Doctoral Fellow, CIMMYT Economics Program, Mexico.** Training and development of new on-farm research methods.
- 1981-82** **Assistant Professor, University of Puerto Rico, Department of Agricultural Economics, Mayaguez, Puerto Rico.** Taught graduate course (M.S. level) on production economics and agricultural development; conducted research on productivity of Puerto Rico's agricultural sector and the economics of selected recreation areas.
- 1974-76** **Associate Researcher, Department of Economics and Graduate Program in Agricultural Economics, National Institute of Agricultural Technology (INTA), Castelar, Prov. Buenos Aires, Argentina.** Worked with a team of economists to assemble a national production information network for policy analysis.

Awards and Honors

Giannini Foundation Fellowship (Ph.D. thesis) (1980); Research Assistantship, Department of Agricultural Economics, University of California, Davis (1978-79); Graduate Fellowship, Ford Foundation (1977-78); B.S. Fellowship, Government of the Entre Ríos Province, Argentina (1968-70).

Professional Memberships

American Agricultural Economics Association, Southern Agricultural Economics Association; Western Agricultural Economics Association; Central America Socioeconomics Network.

VITA

MELINDA SMALE

Education

Ph.D., Agricultural Economics, University of Maryland, College Park, 1992

M.S., Agricultural Economics, University of Wisconsin, 1983

M.A., Johns Hopkins School of Advanced International Studies (Africa Area), 1979

B.A., History, Duke University, 1977

Professional Experience

Present

Senior Economist, Economics Program, International Maize and Wheat Improvement Center (CIMMYT), Mexico. (Current work described in this volume.)

9/1993 - 2/1994

Consultant, CIMMYT Economics Program. Co-authored research report on the state of maize technology and future role of maize research in Malawi.

Invited participant, Yale Program in Agrarian Studies, Colloquium Series.

Visiting Scholar, Department of Agricultural and Applied Economics, University of Minnesota, St. Paul.

1/1992 - 5/1993

Research Associate, CIMMYT. Designed and implemented a farmers' evaluation of maize hybrids newly released by the Malawi Department of Agricultural Research, comparing them to previously released hybrids and local varieties. Organized national radio program to publicize farmers' opinions.

Consultant, Sorghum and Millet Improvement Program, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Bulawayo, Zimbabwe. Evaluated impact of emergency sorghum and millet seed production project in Malawi.

Co-Researcher, Maize Research Impact in Africa (MARIA) Study, Africa Bureau, U.S. Agency for International Development. Prepared case study of the historical impact of maize research in Malawi.

Member, Technical Panel for the Forum on Agricultural Resource Husbandry, Rockefeller Foundation. Participated in the review of research proposals.

9/1989 - 12/1991

Research Associate, CIMMYT Economics Program. In Malawi, projects included:

- Design and implementation of CIMMYT/Malawi Ministry of Agriculture "Maize Variety and Technology Adoption Survey". Managed a team of 21 enumerators conducting detailed household interviews in three of the five major maize-producing zones of Malawi, over two years.
- Entry, editing, analysis of survey data and production of summary reports for CIMMYT and Malawi Ministry of Agriculture.

- Co-instructor, CIMMYT/Malawi Ministry of Agriculture short course, "Principles of Data Analysis and Report Preparation for Social Scientists," August, 1990.
- 1/1987 - 7/1987** **Consultant**, CIMMYT/Islamabad, Pakistan. Based on farm interviews, analyzed the impact of introducing combines on wheat harvest labor and production in Punjab.
- 7/1986 - 10/1986** **Consultant**, FAO/Rome, Women in Agricultural Production and Rural Development Service. Reviewed literature on farm household models and drought survival strategies in sub-Saharan Africa.
- 3/1986 - 4/1986** **Team Member**, Pakistan poultry industry study, prepared for Food Security Management Project and USAID/Islamabad, Pakistan. Prepared poultry industry databook.
- 1985-86** **Agricultural Economist and Project Administrator**, Chemonics International Consulting Division, Washington, D.C. Duties included a combination of technical work in agricultural economics and survey statistics, proposal preparation, and project administration.
- 1984** **Research Analyst**, Department of Agricultural Economics, University of Wisconsin. Prepared and analyzed statistical data for a U.S. Department of Agriculture survey of farm business and off-farm employment characteristics of 2,000 farm households in Wisconsin and Mississippi-Tennessee.
- 1983** **Project Socio-Economist**, Volunteers in Technical Assistance, Mogadishu, Somalia. Designed and supervised survey of fuelwood consumption and cooking practices in refugee, village, and urban project sites.
- 1981-83** **Research Assistant**, Department of Agricultural Economics, University of Wisconsin. Enumerated, coded data, analyzed data for USDA survey project described above.
- 1979-81** **Technical Assistance Specialist**, USDA, Office of International Cooperation and Development, Africa Programs. Assisted in recruiting, editing final reports, drafting country profiles for technical assistance teams. In Mauritania:
- For USAID project design team, surveyed forest product use and management practices of rural communities. (Oct.-Dec. 1980)
 - For USAID, studied women's income-generating activities in farming, pastoralist and refugee families. (May-Oct. 1980)

Professional Memberships

American Agricultural Economics Association, International Association of Agricultural Economists, American Economics Association, Gamma Sigma Delta (Honorary Fraternity of Agriculture).

VITA

MONIKA BARBARA ZUREK

Education

Diploma (equivalent to M.Sc.), Bahia, Brazil, 1996

Course in moderating groups; extension and communication in developing countries, 1996

Tropical Ecology of Pacific Islands course, Java, Indonesia, 1995

Environmental Biology, University of Guelph, Ontario, Canada, 1992-93

Agricultural Biology, University of Hohenheim, Stuttgart, Germany (began in 1990)

Professional Experience

- | | |
|----------------|--|
| Present | Predoctoral Fellow , Economics Program, International Maize and Wheat Improvement Center (CIMMYT), based in Costa Rica. |
| 1994 | Two months' employment at the Center for Soil and Water Care, Soils Institute, University of Guelph, Ontario, Canada. |
| 1994 | Worked for the University of Hohenheim on development projects in Benin and Niger. |
| 1993-96 | Part-time assignment at the Institute for Agroarea and Ecology Planning, University of Stuttgart, Germany. |
| 1989-90 | Work-travel program for 8 months in Southeast Asia; worked on development project in Himachal Pradesh, India. |

8.

Economics Program Publications, 1994-97

Journal articles (published, forthcoming, submitted)

- Asfaw Negassa, K. Gunjal, W. Mwangi and Betene Seboka. 1997. Factors affecting the adoption of maize production technologies in Bako area, Ethiopia. *Ethiopian Journal of Agricultural Economics* (1)2: 52-73.
- Bohn, A., and D. Byerlee. 1994. Costly research investment in wheat improvement research in developing countries. *Food Policy* (submitted).
- Buckles, D. 1995. Velvetbean: A "new" plant with a history. *Economic Botany* 49(1):13-25.
- Buckles, D., and L. Arteaga. 1994. Formación de promotores campesinos en la agricultura sustentable: Resumen de avances en Veracruz. *Acontecer Agropecuario* 6:15-17.
- Buckles, D., and H. Perales. 1995. Farmer-based experimentation with velvetbean: Innovation within tradition. *Experimental Agriculture* (submitted).
- Buckles, D., I. Ponce, G. Sain, and G. Medina. 1994. Uso y difusión de fijol de abono (*Mucuna deeringiana*) en las laderas del Litoral Atlántico de Honduras. *Agronomía Mesoamericana* 5:15-29.
- Byerlee, D., and A. Siddiq. 1994. Has the Green Revolution been sustained? The quantitative impact of the seed-fertilizer revolution in Pakistan revisited. *World Development* 22(9):1345-1361.
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