SOCIO-ECONOMIC ASSESSMENT OF BIOTECHNOLOGIES IN EGYPT

Principal Investigator:

Carl K. Eicher, University Distinguished Professor, Department of Agricultural Economics, Michigan State University (MSU).

Co-operators:

Researchers from AGERI, ARC, and other universities in Egypt;
Larry Busch, Professor, Department of Sociology, MSU;
Derek Byerlee, Director, Economics Program, CIMMYT (Mexico);
Richard Ward, Crop and Soil Sciences, MSU.

Objectives

The purpose of the Socio-economic Assessment of Biotechnologies (SAB) project is to provide needed information to monitor, assess and predict the socio-economic impact of the new technologies being developed by the ABSP project in Egypt. The three principal objectives of the project are to:

1. develop and refine an impact assessment framework to measure the economic, social and environmental costs and benefits associated with the introduction of transgenic crops in Egypt.
2. collect data at different stages of transgenic plant development and dispersion and assess the costs and benefits of new biotechnologies, including the possible reduction of the use of pesticides.
3. trace the socio-economic and environmental consequences of introducing transgenic plant varieties in Egypt.

Rationale

Biotechnology has been heralded as a third revolution in agriculture after chemicals and mechanization (Marks et al. 1992). It offers a new hope for solutions to the pressing problem of feeding the increasing population of developing countries. The projected benefits from the new biotechnologies include increased crop and animal productivity, reduced cost of production of food and raw materials, reduced need for agrichemicals and improved comparative advantage in the production of some commodities (World Bank 1991).

The use of biotechnologies for agriculture, however, has raised some legitimate concerns about physical safety, environmental hazards and socio-economic impacts. Concerns about physical and environmental safety include changes in biodiversity, agricultural sustainability and environmental quality due to the release of bio-engineered plants and animals in the eco-system (Schneider 1993). Concerns about socio-economic impacts have been raised on such issues as income distribution, rural employment, food safety, and changes in commodity prices, asset values, farm structure and production practices.

Biotechnology has spawned a voluminous literature in the past few years (e.g. Busch et al. 1991; Buttle et al. 1985; Baumgardt and Martin 1991; Marks et al. 1992; Kloppenburg 1988; OECD 1989, 1992). However, only a relatively small portions of that literature specifically address the concerns of developing countries. Moreover, the literature has not addressed the consequences of the introduction of new transgenic plant varieties on different sectors of the society. Also, much of the literature to date is based on

conjecture and speculation about the potential impacts of new biotechnologies. Without question, there is a need to study the potential positive and negative implications of biotechnology at the country and commodity levels.

To date, most studies of technological change have usually been done after the adoption is complete (Griliches 1957). This is particularly true for the Green Revolution technology in the developing countries (Eicher 1994). But in order to address the problems of technical change resulting from biotechnology research, there is a need for *ex ante* evaluation of new production possibilities (Maredia 1993; Maredia et al. 1993). Studies of the potential and actual responses to new biotechnologies can assist policy makers in anticipating and minimizing the negative impacts of these technologies.

Egypt has taken important steps to strengthen biotechnology research. The USAID funded Agricultural Biotechnology for Sustainability Productivity (ABSP) project is assisting Egypt with the ultimate goal of producing elite crops, that are resistant to major insect and virus pests and require fewer pesticides. As part of this project, the potato, maize, cucurbits and tomato research teams are working towards developing transgenic crops that will be laboratory and field tested for their effectiveness. Ultimately, the effectiveness of these biotechnologies for Egyptian agriculture will depend as much on social and economic policy choices as on scientific progress. The socio-economic issues need to be systematically addressed in order that Egypt can ensure the success of the new transgenic plant varieties.

Research Approach

The SAB project will focus on biotechnology research of maize and potatoes in Egypt. Since biotechnology will have a "systems" impact, this research project will use a systems approach in analyzing the impact of new transgenic plant varieties on the food and agricultural systems of Egypt. It will take a broader view of impact than that traditionally associated with rate of return analysis (Evenson 1984). The first task will therefore be a review and assessment of the adequacy of theoretical and empirical methods of investigation. The second task will be to develop a conceptual framework that encompasses the social, economic and environmental changes associated with the release and adoption of new transgenic plants.

The major concern of the SAB project will be the social (issues such as income distribution among different producer groups, employment, food prices) and economic impact of new technologies on producers, consumers and the food system that transform agricultural commodities into food products. Attention will be also given to biological diversity, biosafety, farming practices, environment and sustainability (yield stability, chemical pesticide application, etc).

The analysis undertaken by the SAB project will focus on:

1. Technology adoption
    a. Identification of the factors affecting the decision by farmers to adopt new transgenic plant varieties.
    b. Compiling a profile of farmers who are likely to adopt the new biotechnologies.

c. Analysis of rate of diffusion of new trangenic plant varieties, adoption lags and factors influencing participation in the introduction of new varieties.

2. Production assessment

   a. Assessing the yield increments and loss aversion of new transgenic varieties.

   b. economic analysis of changes in product quality.

   c. Assessing environmental issues such as change in chemicals and pesticides use.

   d. Analysis of changes in the commodity prices and farm income of different producer groups due to changes in the quantity and quality of crops produced.

   e. Assessing the impact of new technologies on the demand for farm labor in terms of gender, socio-economic class and regional basis.

   f. Assessing the impacts on food security of producers and consumers.

3. Risk assessment

   a. Analyzing the consequences of new transgenic plants on the food safety; perceived risks and acceptability of new biotechnology products by consumers.

   b. Investigating the environmental risks due to the release of new transgenic plant varieties and implications for biodiversity, land-use, and cropping pattern.

4. The socio-economic aspects of biosafety and Intellectual Property Rights.

   Analyzing the status of and change in legal, regulatory and policy arena.

The assessment and analysis of these different components of biotechnology research will be used to estimate the socio-economic and environmental costs and benefits of new trangenic plant varieties in Egypt.

Research Plan

This research will be carried out in cooperation with social and biological scientists in the Agriculture and Genetic Engineering Research Institute (AGERI), Agricultural Research Council (ARC), National Agricultural Research Program (NARP) and Egyptian universities, if appropriate. A three-stage design is anticipated during the three years of SAB project.

STAGE 1 (October 1994 - March 1995):

Review of literature, review of ABSP-Egypt project, development of the basic impact assessment framework and design data collection and analysis strategies.

STAGE 2 (April 1995 - September 1996):

Data collection and analysis for maize and possibly potatoes. Interviews, observations, documentary analysis, and field data collection will serve as the primary means of gathering the information needed to carry out the various analysis proposed. Data will be collected prior to and during field trials for the transgenic plants, and periodically thereafter depending on the stage of development of the biotechnology research on maize and potatoes.

STAGE 3 (October 1996 - September 1997):

Synthesis of research findings, policy implications and recommendations for further research by AGERI, ARC and NARP.

Research Outcome

The findings of the SAB project will be summarized periodically to inform the ABSP managers, AID and Egyptian collaborators of issues that need proactive attention. The results of the research will be published as research reports, working papers and journal articles, if appropriate. The information and knowledge generated from this project will lead to a more balanced, coordinated and integrated management of technological change in Egypt.

The benefits occuring to Egypt from the SAB project are as follows:

1. The study will generate information on the impact of new transgenic plant varieties on - socio-economic equity, income distribution, food security of farmers and consumers, production systems, biodiversity, agricultural sustainability and optimal public-private research partnerships to achieve overall goals.
2. Research will also generate information on the adoption of new technologies by farmers and perceived risks and acceptability of new products by consumers.
3. This information will contribute to an informed assessment of the biotechnology research in Egypt, provide early signals about possible negative impacts of biotechnologies and guide the scientific community on how to design their research programs and manage the technological change resulting from biotechnology research (Eicher forthcoming).
4. The methodology developed by this research will contribute to the future assessments of the socio-economic impacts of other biotechnologies in Egypt.

Benefits to the ABSP project will be:

1. The information and results of this research will contribute to research collaborations between ABSP and Egypt.
2. The methodology generated from this project on Egypt will serve as a starting point for future investigations of biotechnology research projects in other countries and commodities.

Linkages and Staffing

The SAB project will develop and maintain linkages with other relevant projects and programs. We envision linkages to the ABSP, the Department of Agricultural Economics, the Department of Sociology and various other departments at Michigan State University, the AGERI/ARC/NARP and universities in Egypt, similar projects in International Agricultural Research Centers and other universities in the U.S., Europe and other countries.

The project will be staffed by a full-time researcher (Dr. Mywish Maredia) who will work under the direct supervision of Prof. Carl K. Eicher and will be responsible for designing and conducting the proposed research activities. Research assistants (graduate students at the Michigan State University and/or students and assistants from Egyptian universities and institutes) will be hired to carry out field research in the second and third phase of the project as and when the need arises.

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BUDGET
October 1, 1994-September 1997

	Year 1	Year 2	Year 3	Total
PERSONNEL COSTS				
Researcher (Mywish Maredia)				
Salary (9 months/year)	36,000	37,800	39,690	113,490
Fringe Benefits	12,240	12,852	13,495	38,587
Research Support Staff	5,000	8,000	8,000	21,000
SUPPLIES AND SERVICES				
Office supplies & software	2,000	1,000	1,000	4,000
Communications (telephone, fax, postage, printing,etc.)	1,500	2,000	2,000	5,500
EQUIPMENT				
Computer and printer	3,200	--	--	3,200
TRAVEL: AIRFARE & PER DIEM				
Travel to Egypt	4,000	7,000	7,000	18,000
MSU INDIRECT COSTS (45%)*	27,333	30,893	32,033	90,260
TOTAL	91,273	99,545	103,218	294,037

* On all the above items except equipment.

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Marks, L.A., Kerr, W.A. and Klein, K.K. 1992. Assessing the Potential Impact of Agrobiotechnologies on Third World Countries. *Scince, technology and Development.* Vol. 10, No.1, April 1992, pp. 1-32.

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Education:

1948-52	Michigan State University, Agricultural Economics, B.Sc., 1952
1954-56	Michigan State University, Agricultural Economics, M.Sc., 1956
1957-61	Harvard University, Ph.D., Economics, l961

Positions Held

1992-	University Distinguished Professor, Michigan State University.
1961-92	Professor of Agricultural Economics (1971-92); Associate Professor (1965-71); Assistant Professor (1961-65); Michigan State University.
1985-87	Visiting Professor of Agricultural Economics, University of Zimbabwe and Co-Director, University of Zimbabwe/Michigan State University Food Security Research Program, Harare, Zimbabwe.
1983-84	Visiting Professor of Agricultural Economics, University of Zimbabwe and Senior Agricultural Advisor, Southern Africa Regional Program, U.S. Agency for International Development, Harare, Zimbabwe.
1963-66	Economic Advisor (1963) and Director (1964-66), Economic Development Institute, University of Nigeria.

Honors and Awards

1992	University Distinguished Professor, Michigan State University
1992	Ralph H. Smuckler International Award, Michigan State University
1991	Distinguished Faculty Award, Michigan State University
1986	Foreign Francqui Prize, University of Leuven (Belgium)
1976-77	Fellow, Woodrow Wilson International Center for Scholars, Smithsonian Institution, Washington, D.C.

Selected Publications

Agriculture in Economic Development. L. W. Witt, co-editor. McGraw-Hill, 1964. (Spanish edition, 1966; Bengali edition, 1967).

Strategies and Recommendations for Nigerian Rural Development: 1969-85, G. L. Johnson, O. J. Scoville, and G. Dike, co-authors. Consortium for the Study of Nigerian Rural Development, Department of Agricultural Economics, Michigan State University, 1969.

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"Revitalizing The CGIAR System and NARSs in The Third World," Chapter for Agriculture, Environment and Health: Towards Sustainable Development Into The 21st Century. Edited by Vernon W. Ruttan, Minneapolis, University of Minnesota Press (forthcoming).

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Education:

1984	B.A. Economics, University of Bombay
1986	M.A. Economics, University of Bombay
1993	Ph.D. Agricultural Economics, Michigan State University

Professional Experience:

Associate Scientist, Economics Program, International Maize and Wheat Improvement Center (CIMMYT), Mexico. (September 1993 - present). Preparing research reports and publications on the economics of the international transfer of wheat varietal technology, size of research programs and *ex-ante* resource allocation framework for agricultural research.

Graduate Research Assistant, Department of Agricultural Economics, Michigan State University (June 1989 - May 1993). Conducted statistical analysis of time series micro and macro level production data to estimate yield variability; Participated in a USAID funded project on the assessment of agricultural research; Reviewed the literature on ex-post and ex-ante agricultural research evaluation methodologies and the size and productivity of agricultural research programs.

Summer Assistant, Latin America and the Caribbean Country II Department, Agriculture Operations Division, The World Bank (June - September 1990). Organized Mexican agricultural production data for statistical analysis; Carried out decomposition analysis of growth in the production of major agricultural commodities in Mexico.

Research Assistant, Economics Program, International Maize and Wheat Improvement Center (CIMMYT), Mexico. (January 1988 - February 1989) Developed and managed the data base of important economic indicators and crop statistics; Analyzed data on various aspects of wheat production sector for CIMMYT World Wheat Facts and Trends, 1987-88; Provided research support work to CIMMYT economists and plant breeders.

Honors and Awards: Pre-Doctoral Research Fellowship. International Maize and Wheat Improvement Center (CIMMYT), Mexico, 1992-93

Publications:

Maredia, M.K., Byerlee, D., and Eicher, C.K. Forthcoming. The Efficiency of the Global Wheat Research Investments: Implications for Research Evaluation, Research Managers and Donors. Department of Agricultural Economics Staff Paper (forthcoming). East Lansing: Michigan State University.

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