

Maize Breeding Research in Eastern and Southern Africa: Current Status and Impacts of Past Investments Made by the Public and Private Sectors, 1966-97

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Introduction

Motivation and Objectives of the Study

The International Maize and Wheat Improvement Center (CIMMYT) holds a global mandate to increase maize production and boost the productivity of maize-based cropping systems in developing countries. In pursuing this mandate, CIMMYT collaborates with many public, private, and non-governmental organizations (NGOs) involved in technology development and diffusion activities. A crucial component of CIMMYT's strategy is to develop and distribute improved maize germplasm through an international network of maize breeding and seed production organizations.

During the early 1990s, CIMMYT carried out a study designed to document the impacts of international maize breeding research in developing countries, the results of which were published in 1994 in a report entitled *Impacts of International Maize Breeding Research in the Developing World, 1966-90* (López-Pereira and Morris 1994). The objectives of the study were to document—for CIMMYT, its

collaborators, and the donor community—the impacts of international maize breeding efforts in developing countries. The study generated a wealth of useful information about levels of investment in maize breeding research, the spread of modern varieties throughout the developing world, and farm-level impacts of varietal adoption.¹

In subsequent years, CIMMYT's maize research impacts database served as an important source of information for organizations involved in maize research and development activities. Based on the continuing strong demand for this information, the decision was taken to update and expand the database periodically. Accordingly, a follow-up study was launched in 1997. An additional factor motivating the follow-up study was the need to include more and better data from the private sector, given that limited effort was made during the first study to comprehensively survey private seed companies.

Given the enormity of the data collection task, the follow-up study was divided into three regional studies—one each for Latin America, Asia, and sub-Saharan Africa. The sub-Saharan Africa study focused specifically on eastern and southern Africa;

¹ Throughout this report, the term *varieties* is used in a generic sense to refer to both open-pollinated varieties and hybrids. The term *OPVs* refers much more specifically to open-pollinated varieties that have been improved by a breeding program.

a separate study focusing on western and central Africa was conducted by the International Institute for Tropical Agriculture (IITA), which holds the mandate for maize improvement work in that region. This report presents the results of the eastern and southern Africa study.

The objectives of the eastern and southern Africa regional impacts study resembled those of the Latin American and Asian regional impacts studies:

- to estimate the level of public and private sector investment in maize breeding research;
- to document the germplasm outputs of public and private maize breeding programs;
- to document the use of CIMMYT source materials by public and private maize breeding programs; and
- to estimate the rate of farm level adoption of improved maize germplasm.

Data Collection

The information and analysis presented in this report are based on data collected in 1998 and 1999 through a comprehensive survey of research organizations and seed production agencies located throughout eastern and southern Africa. A structured questionnaire was used to gather information about each organization's maize research activities, maize seed production activities, and/or maize seed distribution activities. Secondary sources also were tapped for additional information about seed regulations and seed policies.

The survey covered 12 countries (Table 1). Collectively, these countries include more than 90% of the total area planted to maize in eastern and southern Africa and account for more than 95% of all maize produced in the region. All major public organizations that engage in maize improvement research and/or seed production were contacted,

Table 1. Coverage of the 1998/99 CIMMYT maize research impacts survey, eastern and southern Africa

Country-region	Public agencies		Number of private seed companies	Total agencies surveyed	Share of formal seed sales (%) in 1996
	Number of research organizations	Number of seed companies			
Ethiopia	1	1	2	4	100
Kenya	1	0	3	4	96
Uganda	1	0	1	2	100
<i>Eastern Africa</i>	3	1	6	10	96
Angola	1	1	2	4	81
Lesotho	1	0	1	2	50
Malawi	1	0	1	2	83
Mozambique	1	0	1	2	100
South Africa	1	0	7	8	100
Swaziland	1	0	1	2	52
Tanzania	1	1	2	4	78
Zambia	1	0	2	3	100
Zimbabwe	1	0	5	6	100
<i>Southern Africa</i>	9	2	22	33	97
<i>Southern Africa, excluding South Africa</i>	8	2	15	25	93
<i>Eastern and southern Africa</i>	12	3	28	43	97
<i>Eastern and southern Africa, excluding South Africa</i>	11	3	21	35	94

Source: CIMMYT Maize Research Impacts Survey, 1998/99.

as were 31 private seed companies (including all of the industry leaders). Between them, these organizations controlled 97% of the total maize seed market in 1996. The survey could not be administered in a few countries due to civil strife, but given that these countries account for a negligible proportion of total regional maize area and production, the omissions are of minimal significance.

Data collection proceeded in stages. First, copies of the questionnaire were mailed to directors of national maize research programs and to senior researchers (mainly plant breeders) in public seed agencies and private seed companies. After the respondents had been given time to review the questionnaire and assemble information, they were personally interviewed, in most cases by one or more of the study authors, and in a few cases by experienced non-CIMMYT researchers. Following the interviews, data recorded in the questionnaires were extensively cross-checked for accuracy and consistency. During this process, staff of the CIMMYT Maize Program helped to resolve numerous questions related to the genetic backgrounds of commercial varieties. In a number of cases, the original respondents were contacted a second time to clear up inconsistencies.

The Maize Economy of Eastern and Southern Africa

Maize dominates the food economy of eastern and southern Africa, where it is by far the dominant staple crop grown by the vast majority of rural households.

Maize Production Environments

Maize in sub-Saharan Africa is produced in a wide range of production environments. Based on agro-climatic factors and grain maturity characteristics, the CIMMYT Maize Program has

identified eight distinct maize production environments, known as *mega-environments*:

- Tropical lowlands
- Tropical mid-altitude zones
- Tropical highlands
- Subtropical lowlands
- Subtropical mid-altitude zones
- Subtropical highlands
- Subtropical winter zones
- Temperate/subtropical zones

These eight mega-environments can be grouped into four basic agro-ecological zones:

1. **Lowland tropical zones** (0-1,000 masl) located in Ethiopia, Kenya, Malawi, Mozambique, Tanzania, Somalia, South Africa, and Zambia cover about 18% of the maize area in eastern and southern Africa. Some areas feature a distinct rainy season, while in other areas rainfall is bimodally distributed. Maize is usually grown as a monocrop or intercropped with grain legumes, sesame, cassava, cowpea, pigeon peas, tomatoes, or rice.
2. **Wet subtropical zones** (900-1,500 masl, >1,000 mm annual rainfall) located in Angola, Burundi, Kenya, Malawi, Mozambique, Rwanda, Swaziland, Tanzania, Uganda, Zambia, and Zimbabwe constitute 49% of the area planted to maize in the region. Rainfall generally decreases as altitude increases. Some areas are characterized by bimodally distributed rainfall, which enables two maize crops to be grown each year. Soils range from deep fertile soils along river bottoms and in lake basins to well drained and easily worked upland soils.
3. **Dry subtropical zones** (900 –1,500 masl, < 1,000 mm annual rainfall) located in Ethiopia, Kenya, Tanzania, Uganda, and Zimbabwe constitute 16% of the area under maize in eastern and southern Africa. These zones are characterized by unreliable and inadequate rainfall, which discourages farmers from investing in inputs such as improved seed and chemical fertilizer.