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## HOW NON-RESEARCH INVESTMENTS AFFECT RESEARCH IMPACT: THE CASE OF MAIZE TECHNOLOGY ADOPTION IN SOUTHERN MALI

By

Duncan Boughton and Bruno Henry de Frahan

Food Security II Cooperative Agreement between U.S. Agency for International Development, Global Bureau, Economic Growth Center,  
Office of Agriculture and Food Security and Department of Agricultural Economics, Michigan State University

**BACKGROUND:** Maize is Mali's most rapidly growing coarse grain subsector. Historically, though, maize has been a minor part of the Malian agricultural research program. The initiative to promote improved maize varieties was instead taken by the cotton parastatal, the Compagnie Malienne pour le Développement des Textiles (CMDT), in response to chronic food deficits during the mid-1970s. The CMDT promoted a sole-cropped maize package consisting of an improved local variety, identified during the period of the colonial administration, and a set of husbandry practices based on research findings generated in other West African countries. Additional varieties were released over time, including a streak-resistant variety from IITA.

**OBJECTIVES:** This study addresses two key questions: (1) what is the profitability, or rate of return (ROR), to investments in maize research and diffusion at the farm and national levels; and (2) what factors have encouraged and constrained the impact of maize investments? Farm-level impacts were assessed by developing financial crop budgets for recommendation domains in two zones served by different rural development agencies, CMDT and Opération Haute Vallée

(OHV). Once the farm-level impacts were determined, the economic impact of maize technology development and extension was estimated through cost-benefit analysis. Economic prices were applied to the crop enterprise budgets, then net benefits were aggregated over the area of improved maize cultivated over time. Costs were estimated by examining the historical expenditures on maize made by the Institut d'Economie Rurale (IER), OHV, and CMDT.

**FINDINGS:** The estimated economic rate of return (ROR) to investment in maize research and extension in southern Mali over the period 1969-90 is 135%. The ROR measures the profitability of an investment; an investment is considered profitable if the ROR equals or exceeds the opportunity cost of capital (in West Africa, this is frequently assumed to be 10%). Thus, maize investments in Mali were extremely profitable. The high rate can be attributed to low research costs (since much of the technical package was borrowed from research conducted elsewhere in West Africa), and the high economic value of maize as an import substitute. Sensitivity analysis indicates that the ROR is robust with respect to adverse changes in



assumptions concerning overvaluation of the exchange rate, research costs, extension costs, and area of improved maize. It is moderately sensitive to price and yield reductions.

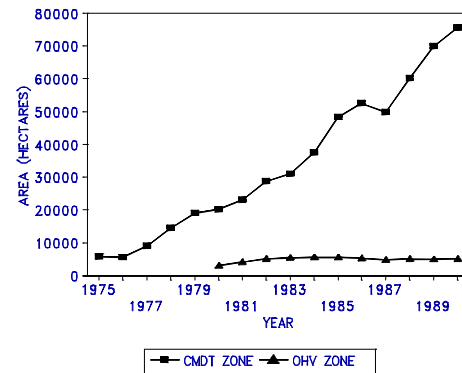
### INFLUENCE OF NON-RESEARCH INVESTMENTS ON TECHNOLOGY ADOPTION:

Adoption of the improved maize package was particularly rapid during the period 1980-86, when an attractive guaranteed price was offered and extension activities were reinforced by a maize project that included the establishment of a seed multiplication program.

The impact of these complementary non-research investments on adoption is clearly reflected in Fig. 1. Fig. 1 shows adoption curves from two regions that are agroecologically similar, but have different physical infrastructure, organizations and human capital bases. In the CMDT areas, farmers had a cash surplus from their cotton sales that allowed them to mechanize and develop their farming systems. When authority to buy maize was transferred to rural development agencies, CMDT was easily able to extend the integrated production, input and product marketing services already established for cotton to maize. By contrast, the other rural development agency in southern Mali, OHV, did not have an integrated technology development and service program in place, and farming systems are considerably less mechanized than in the cotton areas of CMDT.

Although CMDT's approach was effective in terms of boosting adoption rates, it was not financially sustainable. It required high levels of subsidies from the national grain board and the CMDT itself subsidized village-level collection of maize. Following the removal of guaranteed prices for maize in 1986, maize prices fell and have been subject to considerable variability. Area has continued to expand, but farmers have greatly reduced fertilizer use (credit for maize inputs was also withdrawn), switched back to

Figure 1. Adoption of Improved Maize in Mali's CMDT and OHV Zones



maize + late millet intercropping, and substituted early-maturing varieties better suited to their own food security needs.

The high ROR achieved on past investments in a focused, integrated maize technology delivery system is not necessarily a guide to future returns. Market opportunities for maize beyond assuring food security during the "hungry season" are limited due to the lack of low-cost processing technologies in Mali.

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Boughton is a Regional Agricultural Economist with ICRISAT's Southern and Eastern Africa Program, and former Visiting Assistant Professor, MSU. Henry de Frahan is Professor of Agricultural Economics, Catholic University of Louvain, Belgium.

This paper is a summary of a report entitled: "Agricultural Research Impact Assessment: The Case of Maize Technology Adoption in Southern Mali," International Development Working Paper No. 41. It can be obtained by writing to:

MSU Bulletin Office  
10-B Agriculture Hall  
Michigan State University  
East Lansing, Michigan 48824-1039

This paper is also forthcoming as a SD Publication Series technical paper. It can be obtained through USAID's development information system (CDIE), CDIE Reference No. PN-ABS-729.