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ISSUES IN FOOD SECURITY

Agricultural Research and Development, Agricultural Productivity, and Food Security

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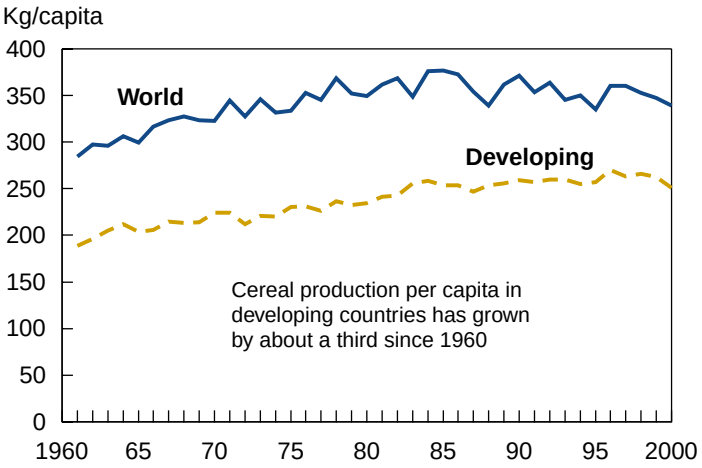
Issue. Sustained growth in agricultural productivity is necessary to improve food security. Investments today in research and development (R&D) for agricultural production are necessary for growth in agricultural productivity tomorrow. Demand for food continues to grow because of increases in both population and income; this increased demand will have to be met chiefly by increased production from agricultural lands already in use, as there is little potential for expansion of farmland area. Without continued funding for agricultural R&D, in particular R&D targeted to the needs of the most food-insecure regions, reducing hunger while protecting the environment is not possible. In fact, without investment in R&D, yields will decline from present levels as new pests and diseases threaten agricultural production. Investments in agricultural R&D that complement other policy measures in enhancing incentives to producers and building infrastructure will continue to play a critical role in promoting agricultural productivity and food security.

Cereal production per capita—world total and developing countries



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Background. Agricultural R&D has been a major contributor to the world's ability to produce more food from limited agricultural land over the past 40 years. From 1960 to 2000, for example, the developing countries' population grew by around 125 percent, while cereals production in developing countries tripled, implying an increase in per capita cereals production of about a third. Over the same period, agricultural land in developing countries increased by only about 25 percent. This transformation in food production was exemplified by the "Green Revolution," based on improved seed and more fertilizer and driven by agricultural R&D. The Green Revolution also markedly reduced the outbreak of famines, particularly in the densely populated countries of Asia.

Over the 1970s and 1980s, investments in public sector agricultural R&D in developing countries grew much faster than investments in developed countries. Nonetheless, developing countries still spend a much lower percentage of the value of their agricultural output on R&D than do developed countries. In developed countries, furthermore, private sector agricultural R&D funding has risen much more rapidly than public sector funding, in response to market incentives. A similar growth pattern holds in developing countries, but the share of private sector agricultural R&D remains low, less than 5 percent of total research expenditures, mainly because of limited private incentives. The international agricultural research centers coordinated by the Consultative Group on International Agricultural Research (CGIAR), financially supported at the international level, also support agricultural R&D in developing countries. These institutes have access to a wide variety of expertise at the global level, but their total annual budget relative to their task is limited (about US$340 million annually in year 2000 dollars, which is even less than private sector agricultural R&D investment in developing countries).

Agricultural R&D investment has been credited as one of the prime drivers of growth in agricultural productivity. Studies have indicated that the rates of return to investment in agricultural R&D tend to be high in both developing and developed countries (table 1).

Table 1—Summary of nearly 400 studies of the economic rate of return to agricultural R&D

Region	Number of studies	Economic rate of return
		Percent/year (median)
Asia	120	≈ 55
Latin America	80	≈ 40
Africa	44	≈ 35
All developing	244	≈ 50
OECD	146	≈ 45

Source: R.E. Evenson *in Handbook of Agricultural Economics*, B.L. Gardner and G.C. Rausser (eds.). North Holland: Rotterdam, 2001.

Despite the successes of past agricultural R&D, many problems and challenges remain, primarily in food-insecure countries. Food-insecure countries are characterized by low incomes, an extensive mode of food production, reliance on subsistence food commodities, and limited trade. The staple foods consumed in these countries are not traded much at the international level, which means they remain a relatively low research priority at the global level. In the lowest income countries, about a third of food consumption is met by non-cereals commodities, for which there have been limited research investments and few technological breakthroughs. Since these countries have limited resources, their national research has had a limited impact on their agricultural productivity. In these countries, even when research results and new technologies have been developed, transferring them to farmers has been difficult because resources for extension activities have been limited. Sub-Saharan Africa is a clear example of this situation. In much of Sub-Saharan Africa, per capita food production actually has declined in the last two decades, a period in which public sector investments in agricultural R&D stagnated in this region.

Although other developing countries performed well in the past (especially in Asia), many are showing signs of a slowdown in agricultural productivity gains. The potential for expansion of agricultural lands is particularly limited in these areas. Environmental problems related to intensive agriculture are one reason for the slowing growth in agricultural productivity. In these countries, raising agricultural productivity in the future will be critical to improving food security, in terms of increasing both food availability and incomes.

Table 2—Agricultural R&D and food security, food-deficit country

R&D focus	Level of food security	Mediating variable
Trading partners	National	Lower import price
Surplus producers	National	Reduced imports
Deficit producers	Household (national)	Income effects

Alternatives. Potential impacts of agricultural R&D on food security in a food-deficit country are summarized in table 2, where they are organized by the different groups that may implement research results. Given the long time periods for R&D to have an effect, the difficulties in targeting R&D directly to the poor, and the availability of other policy instruments, agricultural research is a relatively blunt instrument for achieving distributional objectives. Nonetheless, although shortrun policy measures may have some immediate impact on food security, the longrun efficacy of such measures will be threatened if agricultural R&D is neglected.

Several important policy issues will shape the ability of agricultural research to contribute to food-security objectives:

- To maintain or even increase support for public sector agricultural research, at both the national and international levels. For the foreseeable future, public sector agricultural research will continue to be the research most likely to have an impact on food security. While private institutions may contribute needed funds, the needs of poor farmers and poor regions may take a lower priority in private research driven by profits.
- To maintain access to new technologies and research tools. For this to happen, cooperation between the private and the public sectors will be essential.
- To identify new research areas related to the problems of the most food-insecure regions, including research aimed at addressing resource quality constraints (see *Natural Resources, Agricultural Productivity, and Food Security*, AIB-765-3).
- To develop and fund innovative approaches to extension.
- To foster an environment that encourages agricultural R&D by alleviating institutional constraints to marketing in the short run, and investing in infrastructure in the long run.