8 Economics of Agricultural Research and Biotechnology

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8.1 INTRODUCTION

The issue of the level and source of funding for agricultural research has received considerable attention following the pioneering studies by Griliches in the 1950s (Griliches, 1957, 1958) and cross-country comparisons by Ruttan and colleagues beginning in the 1970s (Ruttan, 1982; Hayami and Ruttan, 1985; Binswanger and Ruttan, 1978). These and subsequent studies have shown social returns to public investment in agricultural research of over 100 per cent in some developing countries, with typical returns exceeding 30 per cent. Since these returns are far higher than can typically be expected from other investments, the argument can and has been made for major increases in public funding of these endeavours. While these results are most dramatic, and pertinent, for developing countries, they also apply to developed countries where agricultural research continues to be heavily supported by the public purse.

Nothing of course is so simple, especially in the dynamic environment of agriculture. Over time a number of additional considerations and interpretations of the returns to publicly funded research have arisen. Methodologically, researchers have raised questions about data and estimation procedures as well as the appropriateness of extrapolating past results to the future, all of which are elements of the debate about under- versus over-investment in this area. Others have re-evaluated the apportioning of returns to the several factors of production as well as the distribution of benefits and have questioned the high returns.
Most topically, the development of biotechnology within the past generation has raised an entirely new and promising area of research which is attracting both public and private research support. This, along with the gradual impoverishment of national treasuries across a wide spectrum of countries, has led to more privately funded agricultural research. The extension of patent and patent-like protection to an ever broader array of agricultural products including, in the USA, animals, is a further component in the shifting of sources and levels of agricultural research funding. Some decry these changes while others see them as not only necessary but desirable.

The objectives of this chapter are first, to review the current status of public and private agricultural research worldwide, and second, to assess the current state of knowledge about the returns to this research. One aspect of that effort is a partial mediation between the strongly held positions of the over- versus under-investment camps. A secondary objective is the use of historical research to generate insights into forms and levels of the ‘new’ agriculture, soon, according to some, to be dominated by biotechnological developments.

The chapter begins with an overview of the current data on public and private investments in agriculture worldwide, and then proceeds to a conceptual evaluation of the ramification of private versus public investment. Section 8.4 evaluates the existing literature on the returns to agricultural research and lessons for the appropriate level of funding. The next to last section applies the lessons learned to the emerging issue of biotechnology and its interaction with ‘traditional’ research. We reserve the final, or sixth, section for the conclusions and implications.

8.2 INVESTMENT IN AGRICULTURAL RESEARCH

The principal objective of research in agriculture is to increase agricultural productivity. This can be accomplished in a number of ways (Arndt and Ruttan, 1977). First, research increases the returns from productive inputs by increasing output or lowering the costs of production. Second, research reduces the risk and uncertainties associated with agricultural production in an environment where many sources of uncertainty exist (Anderson, 1991). Third, research results in improved quality of both outputs and inputs, and, in some case, wholly new products. Improved output quality may be reflected in several ways, through increased economic value, enhanced nutri-