

V. Conclusions

For an economy to move along a more sustainable path of economic development, the economic needs of a growing population must be satisfied. A more sustainable path of economic development for agriculture is one that meets the growing demands for food at reasonable costs to consumers. These costs include any environmental damages to current and future generations caused by agricultural production. An important lesson learned in this report is that no institutional mechanism exists to steer the agricultural sector along a more sustainable path of economic development. Historically, government programs have tried to correct such market failures by directly conserving natural resources. For example, programs such as the Conservation Reserve Program, albeit imperfectly, take the place of market prices and provide incentives for resource conservation. Recently, investment in green technologies has received a great deal of attention because of their potential to increase farm profits and improve the environmental performance of agricultural production. However, simply making a technology available does not necessarily mean it will be adopted. Until markets are developed for the environmental attributes associated with green technologies, farmers will under-use these technologies.

Several conclusions emerge from this report. First, the environmental and natural resource effects of a technology are location-specific. A given technology may be profitable for one farm but not for others within the same region. This limits the power of inferences that can be drawn from individual case studies such as those reviewed in Appendix 1. This is equally true of the environmental benefits of a green technology, which may also exhibit significant spatial variation.

Second, even when a green technology is profitable, there are many impediments to adoption and diffusion such as structural barriers, risk, and heterogeneity of the farm resource base. As a result, a number of poli-

cy instruments must be used to encourage adoption of green technologies. Economic incentives alone may not be enough, as policymakers may need to consider risk management strategies, for example, to deal with the risk associated with adoption of a green technology. Historically, increased adoption has been achieved through two approaches: regulations (e.g., pesticide registration) and incentives (e.g., cost sharing). Our findings indicate that these approaches can be complemented with other approaches.¹⁷

Third, the heterogeneity of the resource base implies that technology transfer programs must be tailored to regional conditions. This follows because the environmental benefits-profitability nexus exhibits spatial variation. A green technology may work in one region but may be totally inappropriate for another region. The empirical findings of this report caution against adopting a "one size fits all" approach to adoption of green technologies.

Finally, there can be environmental trade-offs associated with the technologies examined (e.g., controlling one type of problem might exacerbate another). For example, it is possible that conservation tillage may increase herbicide use while reducing soil erosion. It is necessary to consider such tradeoffs between environmental problems while formulating policy approaches.

The in-depth study of four green technologies has provided information on the potential tradeoffs between environmental quality, natural resource conservation, and the choice of technology. This information provides some background for developing policy implications to move agriculture in a more sustainable direction.

¹⁷These findings were reinforced by participants at a workshop co-sponsored by ERS. Workshop participants suggested a number of policies that could be adopted to steer agriculture in a more sustainable direction (see Appendix 2 and Vasavada, Hrubovcak, and Aldy, 1997).