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Book review

The economics of agricultural technology in semi-arid Sub-Saharan Africa

The Economics of Agricultural Technology in Semi-arid Sub-Saharan Africa. J.H. Sanders, B.I. Shapiro and S. Ramaswamy. Johns Hopkins University Press, Baltimore, MD, 1996, xxiii + 303 pp., US\$55.00, ISBN 0-8018-5139-4.

The last sentence in this book concludes that ...

“It is time to be more optimistic about future agricultural technology development and introduction in semi-arid and subhumid Sub-Saharan Africa”.

The authors’ optimism comes from a belief that better productivity can be achieved in the subhumid and semi-arid tropics of Africa using a three-pronged agricultural development strategy that adapts various combinations of inorganic fertilizer, better water management, and improved cultivars to specific agroecological situations. This optimism is supported by linear programming analyses, survey data on adoption patterns, and an extensive review of the technology development and adoption literature. The authors argue that a first generation of economically profitable technologies addressing the key constraints of soil fertility and soil moisture exists and is now being adopted by African farmers.

Although optimistic about the available technologies and the evidence of adoption in particular case-study situations, the authors point out that more widespread adoption of these technologies is needed. Adoption needs to be encouraged by: (1) government policies and investments, (2) adaptive research programs, and (3) increased private investment in input delivery and farm production systems.

Chapter 1 reviews African agricultural productivity trends, describing how advances in the 1960s and

early 1970s gave way to stagnation and decline during the following decade, due to repeated droughts, incorrect agricultural policies, and poorly managed parastatals. This decline contributed to the economic crisis that forced African nations into structural adjustment programs. Although structural adjustment programs focus on necessary price and institutional changes, the authors maintain that only sustained productivity increases in the basic industries, especially agriculture, can ensure long-term economic growth. Hence, the book’s mission is to examine the technological changes needed in the agricultural sector to ensure this growth.

In Chapter 2 the authors describe and provide arguments in support of their recommended strategy for increasing agricultural productivity. This is an important chapter for policy analysts and those developing strategic programs for the International Agricultural Research Centers (IARCs) and National Agricultural Research Systems (NARs) because many of the recommendations run counter to both conventional wisdom and currently popular agricultural development strategies. The authors propose an “adapted science” model that focuses on developing fertilizer and water management technologies to increase land productivity.

The emphasis on land is in sharp contrast to earlier African farm productivity work, which stressed the need for labor-saving technologies. The emphasis on fertilizer is also in sharp contrast to past research strategies that focused on breeding new cultivars, particularly for cereals.

The authors argue convincingly that land constraints are increasing relative to labor and will continue to do so in the future because of population growth, declining soil quality, and slow growth in

non-farm employment opportunities. They also note that animal traction can alleviate labor constraints and is currently used by more farmers in the semi-arid and subhumid tropics than previously thought. The proposed shift from breeding to fertilizer is based on (1) the limited success to date in introducing improved cereal cultivars on farmers' fields and (2) evidence (presented in subsequent chapters) that fertilizer technologies are profitable.

The authors' hypothesis here is that use of fertilizer will improve soil quality and yields, thereby increasing farm incomes and making the use of animal traction to further intensify land productivity more profitable. A major difficulty with the strategy is that it often requires farmers to adopt three or four new technologies simultaneously in order to realize substantial yield and income benefits. As farmers tend to adopt new technologies sequentially, this strategy will require substantial refinements in extension and credit programs. Another weak link in the strategy is perhaps the assumption that farmers will use animal traction for intensive rather than extensive cultivation in the short- to medium-term as most past experience with animal traction suggests otherwise.

Chapters 3–6 are the principal analytical chapters used to present the results of linear programming analyses that show the normative superiority of the proposed technologies for four different types of cropping systems: Sudano-Guinean (Burkina Faso and Mali), Sudanian (Burkina Faso), Sahelo-Sudanian (Niger), and mechanized rain-fed production (Gezira in Sudan). The key result is the consistently superior profitability and yield-increasing capacity of moderate doses of inorganic fertilizer (N and P_2O_5) in all but the most difficult agroclimatic situations (i.e. Kouka in Niger). The linear programming results are supplemented with a discussion of current adoption patterns (based on survey data or personal communications) and suggestions for improving adoption that touch on such topics as programs to prevent cereal prices from collapsing following abundant harvests, fertilizer subsidies to encourage simultaneous adoption of several technologies, and future improvements in technological packages to deal with second generation problems such as organic matter depletion and potassium deficiencies.

Chapters 7–9 discuss three critical technology research and planning issues: risk, sustainability, and gender. The key findings from linear programming analyses are that (1) risk-perception rather than risk-aversion appears to constrain adoption; (2) long-term sustainability of gains from the authors' proposed strategy requires timely resolution of second generation problems (see previous paragraph); and (3) the technological changes proposed improve the welfare of the entire household and women, even if the technology is introduced only on communally cultivated household plots.

Chapters 10 and 11 discuss two alternative strategies for improving agricultural productivity: disease control to open up new lands and livestock development. In their contributed chapter, D. McMillan and K. Savadogo describe how controlling onchocerciasis in Burkina Faso opened up new agricultural opportunities, yet successful exploitation of these opportunities required substantial investment in technology development and transfer — that is, disease control is not a substitute for technology development. In the livestock chapter the authors are optimistic about future demand for meat and dairy products. They argue that rising demand and prices will encourage technical change in production with more fattening and dairy activities in proximity to population centers and, eventually, intensification of forage production on farm.

Chapter 12 discusses the implications for research and development policy, reiterating the key elements of the authors' proposed strategy. The authors note that much of their optimism is based on the observation that "farmers throughout the region are already shifting to more labor-intensive, lower-yielding variations" of the proposed strategies. To encourage more widespread adoption and movement toward higher-yielding variations of these techniques, the authors identify a number of areas that require attention. Among the more important issues discussed are fertilizer import and subsidy policies, development of input markets, and the design of policies that take into account the differences and the complementarities between high- and low-potential regions.

The book is an important contribution to the debate on agricultural productivity in Sub-Saharan Africa. It challenges readers to revise long-held beliefs about the research strategies and government

policies needed to improve productivity. The book's strength is that it combines a wealth of agronomic trial data with a set of economic analyses that culminate in a concrete proposal for a new technology development and transfer strategy which takes into account issues such as risk, sustainability, and gender. The weakest part of the book is the lack of quantitative evidence presented on adoption of the technologies discussed in the book. It should also be noted that the authors' optimistic prognosis for the future depends largely on assumptions about falling land-labor ratios, introduced in Chapter 2, but perhaps insufficiently documented thereafter. Readers

familiar with the many crop production systems in the semi-arid and sub-humid tropics that are not yet land constrained enough to shift from extensive to intensive production technologies may set the book down a bit more optimistic than when they picked it up, but still not totally convinced that the proposed strategy will achieve the rapid increases in productivity capable of keeping up with population growth.

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