

This is only natural when one realises that the authors have different academic backgrounds and work in quite different institutions. The book's strength lies in the descriptive presentation of how agro-environmental policy has been introduced in different member states and the overall discussion of the associated problems.

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***The Economics of Agricultural Technology in Semi-arid
Sub-Saharan Africa***

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Technological improvement to increase food production is the key to addressing economic growth, alleviating poverty and arresting environmental degradation in much of Sub-Saharan Africa (SSA). Anderson et al. (1994) and Rosegrant et al. (1995) illustrate the importance of agricultural technology in improving food security and reducing poverty in the region. This book, based on over a decade of research on agricultural technology in semi-arid SSA, is very insightful and commendable. By analysing the past and potential performance of new agricultural technologies, the authors show that despite the problems that have confronted SSA in the last two decades, the prospects for agricultural technology development and diffusion are less bleak than often reported, and that agricultural technology is the key to the management of dryland environments.

The book has five parts. Part I deals with the pessimistic outlook on Africa's agricultural potential and presents an agricultural technology development strategy for the semi-arid zone. Chapter 1 looks at the economic and agricultural stagnation in SSA between the second half of the 1970s and the early 1990s. This ideal first chapter focuses the reader's attention on the issues at hand. The authors clearly show how public mismanagement led to declines in agricultural productivity, which contributed to the region's economic crisis in the 1980s. While the authors credit structural adjustment programmes (SAPs) with achieving important changes in pricing and institutions, they argue that long-term growth requires sustained productivity increases in basic industries, especially agriculture. The rest of the book therefore deals principally with the technological changes needed to help agriculture take advantage of the improved economic environment resulting from SAPs.

Chapter 2 discusses a strategy of agricultural technology development for semi-arid and sub-humid regions of SSA. The authors note that traditional cultivars in low-input environments tolerate adverse conditions but often respond poorly to moderate or high input levels. Thus, they advocate a breeding strategy that accounts for moderate increases in inorganic inputs and water availability. They feel that unlike the diffusion model, which has resulted in minimal yield increases, this adapted science model will significantly improve both land quality and productivity. They also argue that low levels of animal traction adoption contradict the reigning view of SSA as a land-surplus region, where seasonal labour availability constrains output response. Unfortunately, this important point is not pursued in subsequent chapters.

Part II (Chapters 3–6) outlines and discusses technology development in specific regions. These chapters discuss empirical results – mostly mathematical programming

models – that deal with technologies for various semi-arid regions in Burkina Faso, Mali, Niger and Sudan. The findings suggest that increased applications of inorganic fertilisers such as nitrogen and phosphorous increase net farm incomes. Irrigation, where feasible, is also shown to play a significant role in income growth and stabilisation, particularly for small farmers in the harsh Sahelo-Sudanian Region. In addition to the results of the normative models, technology adoption is discussed, although little empirical evidence is provided. The authors argue that a fundamental component of technology adoption is that agriculture should be profitable and risk levels reduced.

Part III identifies and discusses critical research and planning issues for technology development using farm programming models. Chapter 7 deals with the question of risk as a critical constraint to higher input use. By analysing the results of programming models, the authors concluded that risk perception rather than risk aversion seems to explain slower adoption rates by farmers. They therefore suggest that risk perception be included in future field work and modelling. Chapter 8 examines sustainability and land market evolution in West Africa and concludes that policy makers and researchers must focus on the adoption of sustainable agricultural technologies. Chapter 9 deals with the impact of new technology on the welfare of women. A small programming model of a representative farm is used to show that technological change improves the welfare of the entire household, including women, even if it is only introduced on family lands. However, women benefit even more from the introduction of new technology on family fields *combined* with increased off-farm employment than from specific measures to introduce new agricultural technologies to them directly.

Part IV of the book considers alternatives to intensive technology development as a means of increasing agricultural output. Chapter 10 provides a discussion of how disease control can help open up new agricultural areas and increase labour productivity. Chapter 11 evaluates the characteristics of new intensive livestock technologies and compares these with the authors' recommendations for crop production. The authors argue that in relatively dry areas with little potential for crops, livestock production provides an important development alternative.

The last part of the book (Chapter 12) discusses implications for research and development policy, touching on issues such as research strategies, barriers, and alternatives to technology development. The authors note that soil degradation and natural resource deterioration are accelerating in the Sudano-Guinean zone as in-migration from drier areas increases. This highlights the need for new technology systems to increase agricultural productivity and preserve the natural base throughout semi-arid and sub-humid regions. Some policy analysts would not agree with the authors' advocacy of fertiliser subsidies, since these have proven unsuccessful in several African countries (e.g. World Bank, 1993).

This book makes an outstanding contribution to the sparse literature on agricultural technology and productivity in semi-arid SSA. The wide variety of topics covered and the long list of references provided make it the most up-to-date reference source in this important area of agricultural and development economics. The book is very well written and chapters that draw on quantitative models include in-depth explanations of these models in appendices. This is a book that one can promptly recommend to policy analysts interested in agricultural technology and development, and specifically agricultural and economic development in Africa.

References

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W. T. Hertel (editor)

Global Trade Analysis: Modelling and Applications

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The Global Trade Analysis Project (GTAP) is the largest effort to provide scientists with a trade model based on an applied general equilibrium framework together with a detailed multi-country, multi-product data base. Tom Hertel, the editor of this book, initiated the project in 1992. Since then, the model and its data-base have been used by economists around the globe. One-week short courses on the GTAP model are offered annually at Purdue University and occasionally overseas. This book is a complement and a supplement to these courses. In the first part of the book, the basic modelling and data components of the GTAP model are described. This part serves as a teaching tool that will enable more people to use the model for their own research. The second part offers well-selected model applications developed by GTAP users. These papers cover a wide range of different topics and applications, and provide a very good indication of the model's potential. The pros and cons of the model are documented, and important economic and data assumptions are made transparent.

Part one of the book starts with a description of the GTAP model. Chapter 2 covers accounting relationships, partial and general equilibrium closures and behavioural equations in the core model. Each region (or country) is represented by private households, producers and governments which are linked in a regional household. The behaviour of regional households is governed by an aggregate Cobb-Douglas utility function, which includes composite private consumption, composite government purchases, and savings. Private demand is modelled using the Constant Difference of Elasticities function which is more flexible than the common CES form. The regional household is connected with a 'global bank' and 'global transport and trade sectors'. These balance international investments and savings and the difference between *fob* and *cif* prices respectively. On the production side, the primary factors land, labour and capital enter CES functions. Imported intermediates are considered *via* the Armington approach. Policy instruments are introduced as price wedges. Using flexibility parameters, fixed capital formation and the allocation of investments across regions are allowed to respond to changes in regional rates of return. The solution of the nonlinear model using a linearised representation (Gragg's method) is also described. Chapter 2 closes with a simple numerical 3-by-3 simulation in which tariffs on EU food imports from the US are cut by 10 per cent.

The data base is discussed in Chapter 3. It encompasses 24 countries (regions) and 37 sectors (goods) and includes bilateral trade flows, transport and protection matrices and country-specific input-output tables. This data base itself is a magnificent