

quality contribution to the social history of science in colonial India. It will be a vital resource not only for those teaching the philosophy and evolution of Indian science, but also to students of higher-degree programmes of any scientific discipline in India. Students, in particular, would find this volume useful in strengthening their understanding of the social dynamics that orchestrated the rise of science and scientific temperament in the recent past in India, and how it is in contemporary India.



**Agriculture in Developing Countries: Technology Issues.** Keijiro Otsuka and Kaliappa Kalirajan (eds). SAGE Publications India Pvt Ltd, B-1/I-1, Mohan Cooperative Industrial Area, Mathura Road, Post Bag 7, New Delhi 110 044. 2008. 163 pp. Price: Rs. 450.

There is no doubt that agriculture in the developing countries is in turmoil. Millions of resource-poor rural farming families are expected to produce enough to ensure food security at the national level, and also manage their own livelihoods and household level food security, in an ever-increasing grim scenario of environmental degradation, acute freshwater shortage and a free but not fair trade in the globalized market. The human population in the developing countries is now growing at an annual rate just above the food production. In addition, unsustainable lifestyle is rapidly exhausting the natural resources. The 'ecological footprint' has exceeded earth's capacity to provide basic human needs and absorb the waste. Also, in many of these countries, the arable land is diverted for non-agricultural purposes. Consequently, several national and international organizations are looking for suitable models to achieve productivity in perpetuity without ecological harm to meet the growing demand for food on the one hand, and increasing the income of the farming families on the other.

Lessons learnt from the green revolution of the 1960s and 1970s are that unless the ecological foundations of agriculture (i.e. water, soil health, biodiversity, atmosphere) are kept intact, high levels of productivity would not be sustainable. The importance of the 'traditional knowledge' of the farming families and the essential need of a 'bottom-up' approach in

developing technologies for farm operations are now well recognized. Further, the rural technologies must be pro-nature, pro-poor and pro-women orientated.

On the premise of the above-mentioned principles, several articles, reviews and books have already been published. The book under review falls in this category.

The book consists of eight chapters written by authors with considerable field experience. In the first chapter, the editors address the technology issues in agriculture in the developing countries. They rightly emphasize the need for a shift from the predominantly 'top-down' approach to integrating the traditional knowledge and experience of the farmers with frontier science and technology in the development and dissemination of ecotechnologies to the rural areas. It is rightly emphasized, 'unlike technological changes in manufacturing industries, realization of potential outputs from agricultural technologies depends largely on farmers' adjustment efforts in production, compounded by the complexity and uncertainty associated with the climate changes'.

The traditional practice based on conventional wisdom of the rice farmers in Bangladesh is effectively brought out by Azad and Hossain. Double transplantation of rice system is an effective strategy to achieve economic efficiency and profitability by greatly minimizing loss due to submergence in the flood-prone rice ecosystem in Bangladesh. Of course, modern plant breeding to evolve submergence-tolerant rice varieties is the relevant technology.

In chapter 3, Ananth *et al.* have shown that agricultural research investment leading to the development of improved varieties of rice and sugarcane and continuous upgradation of technologies has resulted in higher rate of return to agricultural research estimated by using the 'total factor productivity'. The returns were negative in respect of red gram, groundnut and sunflower, which had no investment in research. These are the crops which require less irrigation and are greatly suited for dryland agriculture. More public-funded research in these crops will facilitate yield improvements in the fields of resource-poor small farmers in the largely rain-fed regions.

Chapter 4 by Macleod *et al.* brings out the value of the traditional systems which integrate farm animals and crops in a mutually reinforcing manner. The farm

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animals provide dung and urine to nourish the soil, milk and meat for income generation, while the forage and crop residues in turn form the feed for the animals. However, the point made by the authors about producing and feeding improved forages to enhance the quality of beef production, and the potential to increase the economic welfare of small farmer households is unlikely to hold good for other developing countries. In a 'mixed farming system' in small holdings (~1.0 ha), raising cattle exclusively for beef is unlikely to be sustainable in the long run, especially in India. Conversion of plant proteins and carbohydrates into animal proteins is physiologically and economically inefficient.

In chapter 5, Wise and Cacho examine the impact of crop-tree (intercropping) system on mitigating the climate change by sequestering carbon, which is also an alternative for arresting the land degradation emanating from shifting cultivation and continuous cropping systems. The idea of developed countries investing in greenhouse gas mitigation, including carbon sinks such as small-scale forestry and agro-forestry in the developing countries is laudable, but is far from implementation. Developing a tree-crop system depends on several factors such as carbon content of the soil, economic aspects of planting trees for cycles lasting 20 to 100 years and then returning 80% of pruned biomass to the soil to replenish soil nutrients. This has, therefore, implications for livelihood as well as food security of the resource-poor farmers. Besides, it also goes against the traditional farming of food crops. Intercrop systems involving trees and agricultural crops should be so chosen as to promote complementation and not competition with respect to exhaustion and enrichment of soil nutrients. Alternatively, a landscape approach whereby trees are planted to restore degraded areas, while crops are planted in better land for food and income is likely more acceptable.

Kajisa describes in chapter 6, the vicious spiral between the deterioration of tank irrigation systems and accentuating poverty in India. His analyses of village and household datasets collected in Tamil Nadu where the community-centred tank irrigation system has been traditionally managed for rice cultivation reveal that modern irrigation systems which include private wells with pumps are not only unsustainable, but also fraught

with serious economic problems to both the well-owning farmers as well as no-well-access farmers. The proliferation and dissemination of private wells lead to double tragedies; not only does it result in the collapse of collective management of tank irrigation among the no-well-access farmers, but also in the over-exploitation and profit reduction among well-access farmers. The traditional wisdom is that rainwater collected in the tanks recharges all the wells in the neighbourhood, and therefore collective maintenance of the tanks is prudent.

The lessons drawn from this study must reach the planners, politicians and administrators in Tamil Nadu. Indiscriminate exploitation of groundwater as private property will lead to desertification.

In chapter 7, Otsuka *et al.* examine the impacts of the 'green revolution' technology on income and schooling of children in three ricegrowing villages in the Philippines.

The authors describe an informal land market called 'SANGLA', which is a credit contract system in which the farmer temporarily transfers his cultivation rights in a farmland to a pawnee in exchange for cash, with an agreement to redeem it upon loan repayment without interest charges. With increase in land productivity due to adoption of modern agriculture technology over time, pawning fees under SANGLA contract has increased. This system has emerged as an important source of schooling investment over time by decreasing the household's credit constraints. Consequently, parents invest in the education of their children, who then become equipped for non-farm-sector livelihoods. Such a migration from the agriculture sector is required to a certain extent, but it should not amount to abandoning the farming sector.

In chapter 8, Praneetvatakul and Waibel discuss a model for the assessment of Farmer Field Schools (FFS) in Thailand. They show that farmers who have participated in the FFS practice improved integrated pest management that reduces uneconomical use of chemical pesticides for rice farming. The FFS becomes important in view of the fact that farmers not trained in such schools continue to use chemical pesticides indiscriminately. They spend more money unnecessarily and leave more toxic residue in the soil and water.

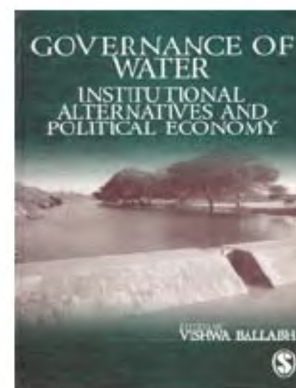
This book suggests possible solutions to various problems in sustaining produc-

tive agriculture in many of the developing countries. Several high expectations such as that agriculture be eco-friendly, be remunerative, generate livelihood, and also produce food at costs affordable by urban middle class are by no means easy to fulfil. The data and case studies compiled and edited by Otsuka and Kalirajan are a step towards achieving the goals of sustainable agriculture and livelihoods for millions of small farmers in the developing countries. The ultimate purpose of these varied approaches is to achieve productivity in perpetuity without ecological harm.

Today agriculture in developing countries is also under increasing stress of climate change and a free but not fair trade in globalization. Hence, the ecotechnologies for on-farm and non-farm enterprises by the self-help groups in the rural areas of developing countries should also enhance the coping mechanisms of resource-poor farming, fishing and landless families against climate and/or market-related setbacks.

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Water governance is defined by the United Nations Development Programme as 'the range of political, social, economical, and administrative systems that are in