Seed Trade
IN RURAL MARKETS

Implications for Crop Diversity and Agricultural Development

Edited by Leslie Lipper,
C. Leigh Anderson and Timothy J. Dalton

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We dedicate this book to the memory of our friend and colleague, Erika C. H. Meng, who pioneered study on the economics of agricultural biodiversity in developing nations. Her contribution to and influence on this book pervades many chapters and is gratefully acknowledged.

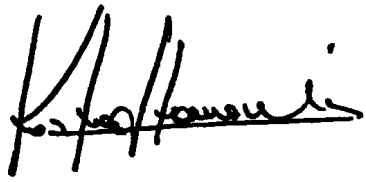
Foreword

Seeds are the basis of crop production, which in turn is the foundation of humanity's food supply. Over centuries, a process of human and natural selection has yielded a wide diversity of crops and varieties that farmers plant to produce food and fibre needed to support the global population and to maintain their own livelihoods. In the recent past, plant breeding has undergone major changes, expanding from selection in farmers' fields to scientific breeding under controlled conditions and, most recently, the use of biotechnology. This process has been accompanied by changes in the way farmers access seed, with the establishment of seed certification systems and commercialized distribution networks. Development of the formal seed system based upon science and regulation has brought significant benefits to many farmers in the form of more productive varieties and better seed quality. However two important criticisms of this strategy have been raised: benefits have largely accrued to commercially oriented farmers in favourable production areas; and the system is leading to a dangerous increase in the erosion and vulnerability of crop genetic resources.

By 2050, the world's population is projected to increase to 9.2 billion people. Agricultural production will need to increase to meet growing food demands and to provide an adequate source of livelihoods for the 50 per cent of the world's population who depend on agriculture for their living. This increase will need to take place under rapidly changing conditions – with shifts in climate, technologies and markets. To meet this enormous challenge, farmers will need access to seeds of a diversity of crops and varieties to meet their specific agro-ecological and market demands. Countries will need to develop policies and institutions to support the sustainable development and use of plant genetic resources for food and agriculture. One such strategy is increasing farmers' access to crop genetic diversity by strengthening the capacity of seed supply systems to provide the range of crops and varieties farmers need, together with information needed to make appropriate selections, delivered at an affordable cost.

The Food and Agriculture Organization of the United Nations (FAO) is actively engaged in assisting countries to achieve a sustainable use of plant genetic resources for food and agriculture through work on improving seed systems, as well as conservation of plant genetic resources. To support this

effort, the Agricultural and Development Economics Division (ESA) of the FAO has developed a programme on the economic analysis of seed supply systems and crop genetic diversity. The research presented in this book is one outcome of the programme. The importance of local markets as a source of seed in the informal sector is one important insight that emerges from the research. The results also suggest that some of the efforts to codify and regulate these markets may actually reduce the welfare of market participants by reducing the diversity of crop genetic resources they can access for seed. However, improving the information about genetic resources in local markets was identified as a potentially important way of benefiting farmers and increasing the diversity of plant genetic resources used on-farm. Combined, these results suggest that efforts to improve informal seed sector supply channels in local markets represent an important way to promote the sustainable use of crop genetic resources and improve farmers' welfare.



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Connie Almekinders graduated as crop physiologist from Wageningen University, The Netherlands, in 1983. From 1983 until 1989 she worked at the International Potato Centre (CIP) in Peru. Her work with the Development Research Institute (IVO) in Tilburg and the Centre for Genetic Resources and the Dutch Gene Bank (CPRO-DLO) focused on farmers, the diversity of crop varieties and seeds. At present she works in the chair group of Technology and Agrarian Development, Department of Social Sciences, Wageningen University.

C. Leigh Anderson holds a PhD in economics and is a professor in the Daniel J. Evans School of Public Affairs at the University of Washington in Seattle, Washington, US. She has also taught or been a visiting scholar at Carleton University, Ottawa, in Canada; the University of California at Berkeley, California; Lahore University of Management Sciences in Pakistan; Renmin University of China in Beijing; and the United Nations Food and Agriculture Organization (FAO) in Rome.

Patrick Audi is an agricultural economist with an MSc from West Virginia University, US. His MSc thesis topic was on *Productivity and Adoption of New Technologies in Smallholder Farms in Semi-Arid Machakos and Kitui Districts, Eastern Kenya*. From the 1980s and 1990s he worked with the Kenya Agricultural Research Institute based in Katumani, Machakos, as socio-economist with responsibilities in research-extension liaison and on-farm participatory research activities. Currently he is based in Nairobi and attached to the International Crops Research Institute for the Semi-Arid Tropics' (ICRISAT's) Seed Systems Research initiatives in Eastern and Southern Africa.

Mauricio R. Bellon is programme director for the Diversity for Livelihoods Programme at Bioversity International (formerly International Plant Genetics Research Institute). He leads an applied research programme supervising a multidisciplinary scientific staff working across the globe in developing countries. His research has focused on the reasons, incentives and dynamics of crop diversity in agricultural systems in the developing world, with a particular emphasis on maize in Mexico; the use of participatory methods in the develop-

ment of agricultural technologies relevant for the rural poor; and the impacts of new agricultural technologies upon farmers' livelihoods.

Romina Cavatassi holds an MSc in Environmental Economics and Assessment from the London School of Economics and is a PhD candidate at Wageningen University, The Netherlands. She has worked with the agricultural sector in the Economic Development Service of the FAO in Rome since 2001 on several aspects of natural resource economics and development. She is an expert in survey design and data collection.

Timothy J. Dalton is an associate professor in the Department of Agricultural Economics at Kansas State University, US. His research focuses on international agricultural development and on the interface between agriculture and the environment. He studies how new varieties of sorghum, rice and maize affect food productivity, production risk management and nutrition, as well as the impact of natural resource degradation – primarily soils and agricultural biodiversity – upon agriculture and human well-being.

Lamissa Diakité is an agro-economist, currently working as a senior researcher at the Institut d'Économie Rurale (IER) in the research programme in Programme Economie des Filières (ECOFIL). Dr Diaketé holds a PhD in Economics from the Université de Ouagadougo, as well as an MSc in Agricultural Economics from the Academy of Agronomic Sciences in Gorky, Belorussia. Having worked at IER since 1982, Dr Diaketé took a brief break in 2006 to undertake a post as an agro-economic expert for the Permanent Inter-State Committee for Combating Drought in the Sahel (CILLS), based at the Institut du Sahel (INSAH). In this role, he was in charge of socio-economic research focused on access to markets and food security for the CILLS member countries and the West African Economic Community (CEDEAO). He returned to his current post at IER in 2008. Dr Diaketé has extensive experience coordinating research with national, regional and international research institutions addressing a variety of topics in African socio-economic development.

Mikkel Grum has a PhD in Agronomy and Plant Breeding from the Royal Veterinary and Agricultural University in Copenhagen, Denmark, where he worked on the genus *Pachyrhizus*, or jicama. Mikkel joined Bioversity International in Cali, Colombia, where he coordinated research activities on the *Passiflora* genus and the *Sapotaceae* family. He later moved with Bioversity to Kenya where he has worked on a range of issues, including participatory approaches to monitoring crop diversity, diversity and climate change, value chains for leafy vegetables, and seed systems. He is currently with Bioversity's Diversity for Livelihoods Programme.

Jon Hellin works as a poverty and value chain specialist at the International Maize and Wheat Improvement Centre (CIMMYT). He has 19 years' agricultural research and rural development experience (including nine years' field work) from Latin America, South Asia, East Africa and the Caribbean. He has a PhD in Geography from Oxford Brookes University, UK, where he is also an honorary research associate, an MSc in Forestry and its Relation to Land Use, and a BA in Modern History from Oxford University, UK.

Toby Hodgkin is the director of the Global Partnership Programme at Bioversity International in Rome, Italy. Dr Hodgkin joined Bioversity (formerly IPGRI) in 1989 to work on different aspects of the conservation and use of the genetic diversity of useful plants. He has wide experience on a number of issues, including conservation and the use of underutilized crop species, improving the use of *ex situ*-conserved germplasm, and the maintenance and use of genetic diversity in agricultural production systems. Prior to joining Bioversity, he worked as a plant breeder/geneticist of Brassica vegetable crops.

Richard Jones is an agronomist by training with over 26 years of experience living and working in Africa. He obtained his PhD from Reading University, UK, in 1989 based on research into two different farming systems in Botswana. After that he accepted a post-doctoral fellowship with the Rockefeller Foundation in Malawi working with the Maize and Agroforestry Commodity Teams. In 1996 he joined ICRISAT as a technology transfer specialist based in Nairobi, Kenya, and is now the assistant director for Eastern and Southern Africa.

Alder Keleman is a Mickey Leland International Hunger fellow based at the FAO in Rome, Italy. A graduate of Yale University, US, she holds an MA in International Relations and an MESc in Environmental Social Science. Her research has explored the impacts of social and economic change upon the maintenance of crop diversity, focusing in particular on maize in Mexico. She was previously based in the Impacts, Targeting and Assessment Unit of CIMMYT in Mexico.

E. D. I. Oliver King is a trained botanist with a PhD on the sacred forest systems in the Kolli Hills of the Eastern Ghats in India. Over the last decade, he has worked extensively at the grassroots level on various natural resource issues within tribal and agrarian communities in Tamil Nadu. Currently at the M. S. Swaminthan Research Foundation, he facilitates projects on conservation and the sustainable use of landraces in participation with the Malayali Tribals at Kolli Hills, Tamil Nadu.

Leslie Lipper is a senior environmental economist in the agriculture and development economics division at United Nations FAO. She has worked at the FAO

over the past seven years developing a programme of research on natural resource economics and poverty reduction. Leslie is the lead author of the FAO State of Food and Agriculture Report 2007, focusing on paying farmers for environmental services.

Madelon Meijer is a policy adviser for agriculture at Oxfam Novib in The Netherlands. She was formerly an associate professional officer in agricultural economics at the United Nations FAO in Rome, Italy. She holds a degree from the Universiteit van Amsterdam and has worked with a number of international development organizations, including The Netherlands Development Organization (SNV), Médecins sans Frontières (MSF) and the UK Department for International Development (DFID).

Latha Nagarajan joined the Department of Food, Resources and Agricultural Economics at Rutgers, the State University of New Jersey, US, in 2008 as research associate. At Rutgers, she is involved in studies on the economic impact of developing and spreading drought-tolerant rice in Asian countries, and the globalization of agricultural research and innovation by the agricultural input industry. Until 2008 she was a post-doctoral research fellow at the International Food Policy Research Institute, where she was responsible for implementing projects on seed systems in India and Kenya. In addition, she has been involved in seed-sector assessment in Niger with ICRISAT, and in marketing under-utilized plant species for the poor with Bioversity International.

Thomas Osborn is an agricultural officer (seed security) for the Seed and Plant Genetic Resource Service of the United Nations FAO. In this role he plans and implements projects in seed policy, national seed production, community seed production and emergency seed relief. He holds an MSc in International Agricultural Development from the University of California, Davis, US, and has over 25 years of experience in seed-related issues in Africa, Latin America, South Pacific and the US.

Álvaro Paz is an agronomist with an MSc in Agri-Business and an MSc in Resource Economics. He has carried out research in institutional economics related to rural development and poverty, as well as the socio-economics of technology, agricultural innovation and seeds. He has also conducted research on rural businesses. Over more than 15 years, his work in these areas has spanned the private sector, the public sector, non-governmental organizations (NGOs) and international cooperation. Having previously been based at the Fundación Promoción e Investigación de Productos Andinos (PROINPA) as a researcher, he is currently a consultant for the Swiss Agency for Development Cooperation (COSUDE), as well as other international agencies working in the Andean region.

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Lina Salazar is a PhD candidate in Economics from the American University in Washington, DC. Her research interests are mainly focused on the areas of agricultural economics, gender economics, migration, project impact evaluation, and credit and microfinance, with a particular concentration in rural areas located in developing countries, particularly in Latin America.

Amadou Sidibé holds an MSc in Seed Technology from the Mississippi State University, US. He was born in Sénou Dioïla, Mali, and did his undergraduate degree at IPR Koulikoro. His experience is primarily in seed technology (certification, field inspection, seed analysis, teaching seed production and rules, seed law enforcement, etc.) and plant genetic resource management and conservation (in situ and on-farm conservation, and *ex situ* conservation). Currently, he is the head of the Genetic Resources Unit at the Institut d'Économie Rurale of Mali.

Melinda Smale has recently joined Oxfam America from the International Food Policy Research Institute, where she led a research programme aimed at promoting the sustainable utilization of crop genetic resources in developing agriculture, initially as a joint programme with Bioversity International in Rome, Italy. Her global research portfolio included work on the economic impacts of agricultural biotechnology, valuation of agricultural biodiversity, local seed markets, and underutilized crops.

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List of Acronyms and Abbreviations

ANOVA	analysis of variance
CBSP	community-based seed production
CEDEAO	West African Economic Community
CILLS	Permanent Inter-State Committee for Combating Drought in the Sahel
CIMMYT	International Maize and Wheat Improvement Centre
CIP	International Potato Centre
CGIAR	Consultative Group on International Agricultural Research
CGR	crop genetic resources
CONAPO	Consejo Nacional de Población
CONASUPO	Compañía Nacional de Subsistencias Populares
COSUDE	Swiss Agency for Development Cooperation
CPRO-DLO	Centre for Genetic Resources and the Dutch Gene Bank
CRS	Catholic Relief Services
CSV	Cellules Semencières Villageoises
DFID	UK Department for International Development
DSD	direct seed distribution
DUS	distinct, uniform and stable
ECOFIL	Programme Economie des Filières
FAO	United Nations Food and Agriculture Organization
FGD	focus group discussion
FIRA	Fideicomisos Instituidos con Relación a la Agricultura
g	gram
GDP	gross domestic product
ICAR	Indian Council of Agriculture Research
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IER	Institut d'Économie Rurale
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
INIFAP	Instituto Nacional de Investigaciones Forestales Agrícolas y Pecuarias
INSAH	Institut du Sahel

IPGRI	International Plant Genetic Resources Institute (now Bioversity International)
IPR	intellectual property right
ITF	input trade fair
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IVO	Development Research Institute
KARI	Kenya Agricultural Institute
KEPHIS	Kenya Plant Health Inspectorate Services
kg	kilogram
km	kilometre
LFT	local farmer trader
LR	long rain
MAP	Makueni Agricultural Project
mm	millimetre
MMT	mobile market trader
MSF	Médecins sans Frontières
MSSRF	M. S. Swaminathan Research Foundation
NAFTA	North American Free Trade Agreement
NGO	non-governmental organization
OPV	open-pollinated variety
ORS	Oficinas Regionales de Semilla
OTFT	one-time farmer trader
PGRFA	plant genetic resources for food and agriculture
PMG	producer-marketing group
PPP	purchasing power parity
PROCAMPO	Programa de Apoyos Directos al Campo
PROGRESA	Programa de Educación, Salud y Alimentación (Education, Health and Food Programme)
PROINPA	Fundación Promoción e Investigación de Productos Andinos
PRONASE	Programa Nacional de Semillas
QDS	quality declared seed
RIGA	rural income-generating activities
SAGARPA	Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (Mexican Agricultural Secretary)
SDR	Secretaría del Campo
SEPA	Empresa de Producción de Semilla
SNV	The Netherlands Development Organization
SR	short rain
SSR	shaker, shatter, resistance measurement test
SSR	simple sequence repeat
SV&F	Seed Vouchers and Fairs
TFL	truthfully labelled

TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
UK	United Kingdom
UPOV	Union for Protection of New Varieties of Plants
US	United States
VCA	value chain analysis
WTO	World Trade Organization

Contents

PART II — COUNTRY CASE STUDIES