

# **Indigenous Fruit Trees in the Tropics**

**Domestication, Utilization and Commercialization**

F.K. Akinnifesi  
R.R.B. Leakey  
O.C. Ajayi  
G. Sileshi  
Z. Tchoundjeu  
P. Matakala  
F.R. Kwesiga



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Front cover

*Pouteria caimito* (Ruiz et Pavon) Radlk (Sapotaceae), known as abiu, caimito or egg fruit, is native to Amazonia and was domesticated by Native Amazonians long before European conquest. The wild populations have small (20–40 g) fruit with abundant latex in the rind; domesticated populations have medium to large (up to 500 g) fruit with less latex. In western Amazonia there are two landraces, differentiated by fruit shape: the more common has the typical egg shape and can weigh as much as 400 g; the less common has a spherical shape and weighs more than 500 g. Early chronicles highlight the popularity of abiu throughout Amazonia, where it was reported to be commonly present in the homegardens of both Native Amazonians and colonists. Today it is still a popular homegarden fruit, although not very important in the market. (Photo credit: F.K. Akinnifesi.)

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# INDIGENOUS FRUIT TREES IN THE TROPICS

## Domestication, Utilization and Commercialization

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Edited by

**Festus K. Akinnifesi**

*World Agroforestry Centre (ICRAF), Lilongwe, Malawi*

**Roger R.B. Leakey**

*James Cook University, Australia*

**Oluyede C. Ajayi and Gudeta Sileshi**

*World Agroforestry Centre (ICRAF), Lilongwe, Malawi*

**Zac Tchoundjeu**

*World Agroforestry Centre (ICRAF), Cameroon*

**Patrick Matakala**

*World Agroforestry Centre (ICRAF), Maputo, Mozambique*

and

**Freddie R. Kwesiga**

*Forum for Agricultural Research in Africa (FARA), Ghana*



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CABI Head Office  
Nosworthy Way  
Wallingford  
Oxfordshire OX10 8DE  
UK  
Tel: +44 (0)1491 832111  
Fax: +44 (0)1491 833508  
E-mail: [cabi@cabi.org](mailto:cabi@cabi.org)  
Website: [www.cabi.org](http://www.cabi.org)

CABI North American Office  
875 Massachusetts Avenue  
7th Floor  
Cambridge, MA 02139  
USA  
Tel: +1 617 395 4056  
Fax: +1 617 354 6875  
E-mail: [cabi-nao@cabi.org](mailto:cabi-nao@cabi.org)

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## Contributors

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- Oluyede C. Ajayi, *PhD*, is an Agricultural Economist with the World Agroforestry Centre (ICRAF), PO Box 30798, Lilongwe, Malawi.
- Festus K. Akinnifesi, *PhD*, is a Senior Tree Scientist with the World Agroforestry Centre (ICRAF), PO Box 30798, Lilongwe, Malawi.
- Paul Anegbeh, *PhD*, is with the World Agroforestry Centre (ICRAF) West and Central Africa Region, Humid Tropic Node, IITA Station, Onne-Wharf Road, PMB 008, Nchia, Eleme, Port Harcourt, Rivers State, Nigeria.
- Ebenazar Asaah is with the World Agroforestry Centre (ICRAF) West and Central Africa Region, Humid Tropic Node, BP 16317, Yaounde, Cameroon.
- A. Atangana is with the World Agroforestry Centre (ICRAF) West and Central Africa Region, Humid Tropic Node, BP 16317, Yaounde, Cameroon.
- R.R. Bandeira is with the Eduardo Mondlane University, Maputo, Mozambique.
- Pia Barklund, *PhD*, is an Associate Professor at the Swedish University of Agricultural Sciences (SLU), Department of Forest Mycology and Pathology, Box 7026, SE 75007 Uppsala, Sweden.
- Colm Bowe, *PhD*, is with the Centre for Underutilised Crops, Environmental Sciences Division, School of Civil Engineering and the Environment, University of Southampton, Southampton SO17 1BJ, UK.
- Thomson Chilanga is a Horticulturalist with Buumbwe Agricultural Research Station, Box 5748, Limbe, Malawi.
- Clement Chillima, *PhD*, is a Pest Scientist with the Forestry Research Institute of Malawi, Zomba, Malawi.
- Paxle W. Chirwa, *PhD*, is a Senior Lecturer at Stellenbosh University, Department of Forest and Wood Science, Stellenbosh 7602, South Africa.
- Charles R. Clement, *PhD*, is a Senior Scientist with the Instituto Nacional de Pesquisas da Amazônia, Av. André Araújo, 2936 Aleixo, 69060-001 Manaus, Amazonas, Brazil.
- Jonathan P. Cornelius, *PhD*, is a Senior Scientist with the World Agroforestry Centre (ICRAF), CIP, Apartado 1558, Lima 12, Perú.

- Roger K. Day, PhD, is a Pest Scientist with the CAB International Africa Regional Centre, PO Box 633, United Nations Avenue, Nairobi, Kenya.
- Caroline de Kock is the CEO of Speciality Foods of Africa Pvt Ltd, Harare, Zimbabwe.
- Ann Degrande, PhD, is a Social Scientist with the World Agroforestry Centre (ICRAF) West and Central Africa Region, Humid Tropic Node, BP 16317, Yaounde, Cameroon.
- Zoë Dunsiger, PhD, is with the Centre for Underutilised Crops, Environmental Sciences Division, School of Civil Engineering and the Environment, University of Southampton, Southampton SO17 1BJ, UK.
- Charly Facheux is with the World Agroforestry Centre (ICRAF) West and Central Africa Region, Humid Tropic Node, BP 16317, Yaounde, Cameroon.
- Divine Foundjem is with the World Agroforestry Centre (ICRAF) West and Central Africa Region, Humid Tropic Node, BP 16317, Yaounde, Cameroon.
- Steven Franzel, PhD, is a Principal Agricultural Economist at the World Agroforestry Centre (ICRAF), PO Box 30677, Nairobi, Kenya.
- Cori Ham is a Lecturer and Co-ordinator of the Commercial Product of the Wild (CP Wild), Department of Forest and Wood Science, University of Stellenbosch, Private Bag X1, Matieland 7602, South Africa.
- Chris Hansmann, PhD, is a Senior Researcher with the Agricultural Research Centre, Infruitec-Nietvoorbij, Private Bag X5013, Stellenbosch 7599, South Africa.
- Nazmul Haq, PhD, is the Director of the Centre for Underutilised Crops, Environmental Sciences Division, School of Civil Engineering and the Environment, University of Southampton, Southampton SO17 1BJ, UK.
- Danië du P.S. Joordan is a Lecturer at the Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, Pretoria 0002, South Africa.
- Irene Kadzere, PhD, is a Post Harvest Scientist with the World Agroforestry Centre (ICRAF), c/o Division of Agricultural Research and Extension, 5th Street Extension, PO Box CY594, Causeway, Harare, Zimbabwe.
- Antoine Kalinganire, PhD, is a Senior Scientist with the World Agroforestry Centre (ICRAF) West and Central Africa Region, BP 320, Bamako, Mali.
- Jacques Kanmegne is with the World Agroforestry Centre (ICRAF) West and Central Africa Region, Humid Tropic Node, BP 16317, Yaounde, Cameroon.
- Brehima Kone is with the World Agroforestry Centre (ICRAF) West and Central Africa Region, BP 320, Bamako, Mali.
- B.M. Kumar, PhD, is a Professor at the Department of Silviculture and Agroforestry, College of Forestry, Kerala Agricultural University, Thrissur 680656, Kerala, India.
- Freddie R. Kwesiga, PhD, is the Coordinator of the Sub-Saharan African Challenge Programme, PMB CT 173 Cantonments, 2 Gowa Close, Roman Ridge, Accra, Ghana.
- Roger R.B. Leakey, PhD, is a Professor of Agroecology and Sustainable Development, Agroforestry and Novel Crops Unit, School of Tropical Biology, James Cook University, PO Box 6811, Cairns, Qld 4870, Australia.
- Vincent Lebot, PhD, is a Senior Researcher with CIRAD, PO Box 946, Port-Vila, Vanuatu.



- Anxious J. Masuka is with the Kutsaga Research Company (Pvt) Ltd, Airport Ring Road, PO Box 1909, Harare, Zimbabwe.
- Patrick Matakala, PhD, is the Principal Scientist with the World Agroforestry Centre (ICRAF) Mozambique, Zaixa Postal 3658, Av. Das FPLM, 2698 Mavalane, Maputo 8, Mozambique.
- Peter Mbile is with the World Agroforestry Centre (ICRAF) West and Central Africa Region, Humid Tropic Node, BP 16317, Yaounde, Cameroon.
- Charlie Mbosso is with the World Agroforestry Centre (ICRAF) West and Central Africa Region, Humid Tropic Node, BP 16317, Yaounde, Cameroon.
- Gerald Meke is a Pest Scientist with the Forestry Research Institute of Malawi, Zomba, Malawi.
- Jarret Mhango is a Lecturer with the Mzuzu University, Forestry Department, Private Bag 201, Luwingu, Mzuzu, Malawi.
- Dagmar Mithöfer, PhD, is an Agricultural Economist with the International Centre of Insect Physiology and Ecology, PO Box 30772-00100, Nairobi, Kenya.
- Alfred Mkonda is a Horticulturalist, with the World Agroforestry Centre (ICRAF) Zambia, Msekera Research Station, PO Box 510046, Chitapa, Zambia.
- Simon A. Mng'omba is a PhD Research Fellow with the Department of Plant Production and Soil Science, Faculty of Natural and Agricultural Sciences, University of Pretoria, 0002 Pretoria, South Africa.
- Bernadette K. Ndabikunze, PhD, is a Senior Lecturer at the Department of Food Science and Technology, Sokoine University of Agriculture, PO Box 3006, Morogoro, Tanzania.
- Peter A. Oduol, PhD, is a Scientist with the World Agroforestry Centre (ICRAF) Mozambique, Av. Das FPLM 2698, Caixa Postal 1884, Maputo, Mozambique.
- Mario H. Pinedo-Panduro is a Researcher with the Instituto de Investigaciones de la Amazonia Peruana, Avda. Abelardo Quiñones, km 2.5, Iquitos, Perú.
- Tunu Ramadhani, PhD, is Marketing Researcher at the University of Hanover, Herrenhauserstrasse 2, 30419 Hanover, Germany.
- Thadée Sado is with the World Agroforestry Centre (ICRAF) West and Central Africa Region, Humid Tropic Node, BP 16317, Yaounde, Cameroon.
- John D.K. Saka, PhD, is a Professor at the Chemistry Department, Chancellor College, University of Malawi, PO Box 280, Zomba, Malawi.
- C. Sam is with the MQAFF, National Herbarium, PMB Port-Vila, Vanuatu.
- Erich Schmidt, PhD, is a Professor at the University of Hanover, Herrenhauserstrasse 2, 30419 Hanover, Germany.
- Gudeta Sileshi, PhD, is a Pest Management Scientist with the World Agroforestry Centre (ICRAF), PO Box 30798, Lilongwe Malawi.
- Honoré Tabuna is a Marketing Researcher with the World Agroforestry Centre (ICRAF) West and Central Africa Region, Humid Tropic Node, BP 16317, Yaounde, Cameroon.
- Zac Tchoundjeu, PhD, is a Principal Tree Scientist with the World Agroforestry Centre (ICRAF) West and Central Africa Region, Humid Tropic Node, BP 16317, Yaounde, Cameroon.
- Zewge Teklehaimanot, PhD, is a Senior Lecturer at the School of the Environment and Natural Resources, University of Wales Bangor, Gwynedd LL57 2UW, UK.

- Bendantunguka P.M. Tiisekwa, *PhD*, is a Professor at the Department of Food Science and Technology, Sokoine University of Agriculture, PO Box 3006, Morogoro, Tanzania.
- Alain Tsobeng is with the World Agroforestry Centre (ICRAF) West and Central Africa Region, Humid Tropic Node, BP 16317, Yaounde, Cameroon
- Marcel Useni is with the World Agroforestry Centre (ICRAF) West and Central Africa Region, Humid Tropic Node, ICRAF Office, Kinshasa, Democratic Republic of Congo.
- Annonciata Uwamariya is a Consultant in Agroforestry and Environmental Management, BP E570, Bamako, Mali.
- Hermann Waibel, *PhD*, is a Professor at the Faculty of Economics and Management, Leibniz University of Hanover, Königsworther Platz 1, 30167 Hanover, Germany.
- Annie Walter is with the IRD (Institut de Recherche pour le Développement), Agropolis, Montpellier, France.
- John C. Weber, *PhD*, is a Senior Consultant with the World Agroforestry Centre (ICRAF) West and Central Africa Region, BP 320, Bamako, Mali.
- K. Freerk Wiersum, *PhD*, is a Senior Lecturer with the Forest and Nature Conservation Policy Group, Department of Environmental Sciences, Wageningen University, PO Box 47, 6700AA Wageningen, The Netherlands.
- Kaoru Yuyama is a Researcher with the Instituto Nacional de Pesquisas da Amazônia, Av. André Araújo, 2936 Aleixo, 69060-001 Manaus, Amazonas, Brazil.

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## Preface

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Agriculture is at the core of rural livelihoods. The viability of rural livelihoods in many developing nations is threatened by several interconnected factors which reduce options for smallholder farmers and rural community dwellers. These include: inadequate food and nutritional imbalance in diets; narrow opportunities for off-farm and off-season income, especially for women and children; and depleting production systems. These negative impacts of modern agriculture are further exacerbated by the loss of biodiversity of wild forest resources due to deforestation, overexploitation and the 'tragedy of the commons'.

Historically, fruit trees were the earliest source of food known to mankind and wild-harvesting of indigenous fruit trees predated hunting and settled agriculture. There are also strong links with culture and religion, starting with the biblical 'fruit tree of life' in the Garden of Eden. Jewish history documents how the spies sent to the land of Canaan in 1490 BC had seen and collected fruits from cultivated or domesticated grapes, pomegranates and figs from the Valley of Eshcol (Numbers 13:23). An Indian king was reported to have encouraged the cultivation of mangoes, jackfruits and grapes in 273–232 BC, while in AD 300–400, Vatsyana commented on the importance of fruit trees in his book on Hindu aesthetics (Chapter 4, this volume). Coconut cultivation was documented by a Persian traveller visiting the Malabar Coast of Kerala in 300–100 BC (Chapter 4, this volume). More recently, mangosteens from Asia were the preferred official fruit at banquets in England during the reign of Queen Victoria (1837–1901) (Silva and Tassara, 2005). Today, these fruits are cultivated, commercialized and found in supermarkets world-wide.

The indigenous fruit and nut trees (IFTs) of the tropics, have been described as 'Cinderella species' because they have been overlooked by science and development (Leakey and Newton, 1994). They now represent a unique asset that could be developed, domesticated and owned by farmers. In this sense, IFTs differ from the conventional tropical and subtropical horticultural tree crops such as mango (*Mangifera indica* L.), orange (*Citrus sinensis* L.), coconut



(*Cocos nucifera* L.), breadfruit (*Artocarpus* spp.), mangosteen (*Garcinia mangostana* L.), rambutan (*Nephelium lappaceum* L.), banana (*Musa* spp.), papaya (*Carica papaya* L.), cashew (*Anacardium occidentale* L.), cacao (*Theobroma cacao* L.), avocado (*Persea americana* Mill.), guava (*Psidium guajava* L.), oil palm (*Elaeis guineense* Jacq.) and coffee (*Coffea arabica* L.), which are not covered by this book. These species were typically developed as crops by research institutes as part of the gains of the colonial era, a process which has continued since independence, although often with substantially lower levels of public investment. These fruits have become 'cash crop' commodities in the global market, and have been improved more with the needs of overseas consumers in mind than those of the local people who produce them. It is often assumed that there is no need for new tree crops, but in recent years the domestication of IFTs has been seen as an opportunity to meet the needs of poor smallholder farmers and thereby to enhance the livelihoods of more than 50% of the world population living on less than US\$2 per day. To realize this potential role of IFTs in rural development and to raise their international profile as new crops, Simons and Leakey (2004) proposed that the products of these new tree crops should be called Agroforestry Tree Products (ATFPs) to distinguish them from Non-Timber Forest Products (NTFPs), which are extractive resources from natural forests.

Up until the late 1980s there was almost no scientific work on indigenous fruit trees and little was known about their biology, ecology or social impact on rural populations, and it was generally thought that they are not amenable to cultivation. However, subsistence farmers have been the custodians of these IFTs, and in many societies these species have deep cultural significance, often associated with taboos and community regulations around their conservation and use. Since the early 1990s, the domestication of IFTs has become a new and active field of research and development led by the World Agroforestry Centre (ICRAF) and partners around the world. New concepts and approaches have been developed, case studies have been produced, and evidence-based research is being undertaken on the potential and feasibility of domesticating IFTs and commercializing their products, for the benefit of rural communities.

In this book we focus on the 'underutilized' indigenous fruit trees in order to further promote recognition of the role they can play in meeting the rural development goals of the new millennium. This role is currently being highlighted by the International Assessment of Agricultural Science and Technology for Development (IAASTD), which recognizes that sustainable agriculture is dependent on the multifunctionality of farming systems, supporting environmental and social sustainability, providing food, enhancing health and nutrition, while at the same time promoting economic growth. Although the concepts and principles presented in this book are not unique to the tropics, we have chosen to concentrate on the IFT species of the tropics and subtropics, as they have the greatest underutilized potential. This volume has gathered together contributions providing state-of-the-art information on IFT research and development to complement existing knowledge – principally from proceedings of conferences and technical meetings (Leakey and Newton, 1994; Maghembe, 1995; Leakey and Izac, 1996; Shumba *et al.*, 2000), special

issues of scientific journals (Leakey and Page, 2006), and a range of research articles, species monographs and agroforestry textbooks. The studies reported in this book span a wide range of approaches and practices. The authors have experience in all facets of the fruit-tree supply chain – from wild collection to the nursery (propagation, cultivation), utilization and marketing; from academic research to the practical needs of farmers, marketeers, industry, policy makers and investors.

The 21 chapters cover a wide spectrum of topics. The book begins with general principles, methods and practices that are cross-cutting (Chapters 1–3), and a series of case studies across subcontinents (Asia – Chapters 4 and 5; Latin America – Chapter 6; Oceania – Chapter 7; and Africa by region: Southern Africa – Chapter 8; West and Central Africa – Chapter 9; the Sahel zone – Chapter 10; and Eastern Africa – Chapter 11). These are followed by a set of studies (Chapters 12–21) in southern Africa aiming to understand the AFTP supply chain from production to the market (markets, economics, nutritional value, enterprise development and feasibility assessments of IFTs – Chapters 12–16), institutional policy and indigenous knowledge in utilization of IFTs (Chapter 17), ecology and biology, germplasm production and pest management (Chapters 19–20). The final chapter (Chapter 21) provides a synthesis of the concepts, principles and methods, practices and results, and how IFT research can be of direct benefit to farmers, scientists, development communities and investors when developing, managing and commercializing these natural assets. Readers need to appreciate that IFT domestication must be viewed within the context of wider natural resource management at the farm and landscape level.

This book links the exploration, husbandry and domestication of IFTs with the markets, and broader transdisciplinary concern on the promotion of growth and poverty reduction for rural farmers. We hope it will improve understanding of smallholder needs, constraints and priorities, as well as the practices for the development of technological and market-oriented solutions aimed at improving the livelihoods of smallholders. Four questions may assist the reader: (i) How can farmers and entrepreneurs benefit from IFT domestication and commercialization? (ii) How can the experience and knowledge gained so far be integrated into smallholder farming systems? (iii) What research topics are emerging as priorities for the future? (iv) What are the drivers of change in the domestication and commercialization of IFTs in the tropics?

As the development sector refocuses its attention on poverty, food security and malnutrition, it is important to think again about the potential contribution of the 'Cinderella fruits' of the tropics. In what we hope is a turning point in tropical IFT research and development, this book brings together authors from Africa, Asia, Oceania, Latin America and Europe, with rich experience on domestication and commercialization of IFTs, in order to broaden and deepen our understanding of the challenges and opportunities facing these 'hidden commodities', and the constraints that prevent poor farmers from getting out of poverty. The book is an appropriate example of how cooperation between research, investors and communities can signal a beacon of hope to farmers in the development of new crops.

We hope that this book will not only provide information on the extent to which indigenous fruit trees have been researched and understood, but also show the extent of domestication and technological solutions, the relevance of creating and expanding markets, and how institutional property rights and policy interventions can facilitate the process, and encourage further research and investment in this important area.

Festus K. Akinnifesi and Roger R.B. Leakey

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## Foreword

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This book on indigenous fruit trees in the tropics documents some of the ways in which the use of indigenous fruit trees in traditional and modern agroforestry systems can substantially contribute to achieving the Millennium Development Goals in low-income countries, by creating new cultivars of high-value trees, new enterprises and market opportunities for tree products, and crop diversification and maintenance of biodiversity on-farm.

Domesticating indigenous fruit trees is an alternative avenue to unlocking the potentials of genetic materials and indigenous knowledge in rural communities. A research and development strategy is advocated that reduces their dependency on the few primary agricultural commodities, based on creating new and superior fruit tree crops, with potential for establishing value-added products and tapping into emerging market opportunities.

Indigenous tree crops are a major opportunity for asset building for smallholder farmers. Most market studies reported in the book have pointed to women and children as the major beneficiaries of indigenous fruits and fruit product enterprises. Domestication and commercialization interventions will help increase returns and market shares to this segment of the rural population and help address gender inequality in income and farm opportunities.

The domestication of kiwi fruit (*Actinidia chinensis*) was a classic case of a new horticultural fruit of international significance. It was first grown commercially in New Zealand in the 1930s, despite its more than 1000 years' history in China. That success was achieved by farmer-led domestication and commercialization efforts. The selection of the macadamia nut (*Macadamia integrifolia*) from Australia also began in 1934, motivated by promising market interests. The domestication of many other trees of the tropics was triggered by globalization, especially during the colonial conquests, followed by growing market demand that promoted research and cultivation.

For tropical indigenous fruit trees, farmer-driven and market-led participatory domestication can cut short the long cycles of improvement and slow market

development to create novel cash crops and opportunities for smallholders. This was the major thinking behind the Agroforestry Tree Domestication Programme pioneered by the World Agroforestry Centre (ICRAF) since the early 1990s. Tree domestication is now one of the key pillars of the global programmes of the centre, building on the efforts of smallholder farmers and our partners. The centre implements its domestication research and development work in eastern, southern, western and central Africa, south and South-east Asia, and Latin America.

The World Agroforestry Centre defines tree domestication as encompassing the socio-economic and biophysical processes involved in the identification, characterization, selection, multiplication and cultivation of high-value tree species in managed ecosystems. The term has now been expanded to include not just species but also landscape domestication. This concept encompasses the whole set of activities required to cultivate, conserve and manage indigenous fruit trees in an ecosystem, including agroforest and forest gardens of the humid regions of the tropics.

Readers of this book will recognize the importance of indigenous fruit trees in providing economic benefits to smallholder farmers and small-scale entrepreneurs in low-income countries in the tropics. The market advances of new crops such as peach palm (*Bactris gasipaes*), guaraná (*Paullinia cupana*), camu camu (*Myrciaria dubia*), açai (*Euterpe oleracea*) and Brazil nut (*Bertholletia excelsa*) in Latin America, durian (*Durio zibethinus*) and tamarind (*Tamarindus indica*) in Asia, and shea (*Vitellaria paradoxa*), marula (*Sclerocarya birrea*), safou (*Dacryodes edules*) and cola nut (*Cola esculentum*) in Africa, are a few of the success stories of indigenous fruit tree domestication. The range of work on domestication and commercialization of these 'hidden treasures' of the wild, and how they have been brought into cultivation and marketed in local, national, regional and international markets, has rarely been documented in one single book.

This volume systematically reviews and documents tree domestication experiences in the tropics. The authors are renowned scientists on indigenous fruit tree domestication and agroforestry. The book provides a solid foundation on which new science, partnerships and market opportunities can be further developed. It is geared to researchers, academics and students in agroforestry, horticulture, and forestry interested in creating new opportunities for smallholder farming communities. As the 21 chapters of the book show, there is much to be learnt and discovered. The hard work and dedication of the authors have resulted in a work of such comprehensiveness that is assured to stand for many years as an important landmark in the literature of indigenous fruit domestication, utilization and commercialization.

Dennis Garrity  
Director General  
World Agroforestry Centre  
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