



HAL
open science

Sustainable Agriculture Reviews 14

Harry Ozier Lafontaine, Magalie Lesueur-Jannoyer

► **To cite this version:**

Harry Ozier Lafontaine, Magalie Lesueur-Jannoyer. Sustainable Agriculture Reviews 14: Agroecology and Global Change. Springer International Publishing, 14, pp.511, 2014, Sustainable Agriculture Reviews, 978-3-319-06015-6. 10.1007/978-3-319-06016-3 . hal-02801642

HAL Id: hal-02801642

<https://hal.inrae.fr/hal-02801642>

Submitted on 5 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Copyright

Sustainable Agriculture Reviews

Volume 14

Series Editor

Eric Lichtfouse

For further volumes:

<http://www.springer.com/series/8380>

*Other Books by Dr. Eric Lichtfouse**

Sustainable Agriculture

Sustainable Agriculture, Volume 2

Organic Farming, Pest Control and Remediation of Soil Pollutants

Climate Change, Intercropping, Pest Control and Beneficial Microorganisms

Sociology, Organic Farming, Climate Change and Soil Science

Genetic Engineering, Biofertilisation, Soil Quality and Organic farming

Biodiversity, Biofuels, Agroforestry and Conservation Agriculture

Alternative Systems, Biotechnology, Drought Stress and Ecological Fertilisation

Genetics, Biofuels and Local Farming Systems

Agroecology and Strategies for Climate Change

Organic Fertilisation, Soil Quality and Human Health

Environmental Chemistry. Green Chemistry and Pollutants in Ecosystems

Farming for Food and Water Security

Environmental Chemistry for a Sustainable World

Volume 1. Nanotechnology and Health Risk

Environmental Chemistry for a Sustainable World

Volume 2. Remediation of Air and Water Pollution

Rédiger pour être publié ! Conseils pratiques pour les scientifiques

Call for review articles

Authors wishing to publish a review article in *Sustainable Agriculture Reviews or Environmental Chemistry for a Sustainable World* should contact the Editor.

E-mail: Eric.Lichtfouse@dijon.inra.fr

*Eric Lichtfouse is Chief Editor and founder of impact-factor journals and book series. He is giving conferences, lectures and workshops on scientific writing and communication in Europe and the USA. He has founded publication assistance services to help authors, institutes and universities. For further information see LinkedIn, ResearchID and Google Scholar Citations.

Harry Ozier-Lafontaine
Magalie Lesueur-Jannoyer
Editors

Sustainable Agriculture Reviews 14

Agroecology and Global Change

 Springer

Editors

Harry Ozier-Lafontaine
INRA, UR1321, ASTRO Agrosystèmes
Tropicaux
Petit-Bourg, France

Magalie Lesueur-Jannoyer
HortSys Research Unit
CIRAD
Caribbean Agroenvironmental Campus
Le Lamentin, Martinique, France

ISSN 2210-4410

ISBN 978-3-319-06015-6

DOI 10.1007/978-3-319-06016-3

Springer Cham Heidelberg New York Dordrecht London

ISSN 2210-4429 (electronic)

ISBN 978-3-319-06016-3 (eBook)

Library of Congress Control Number: 2014942694

© Springer International Publishing Switzerland 2014

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

I like farmers because they are not learned enough for wrong thinking

Montesquieu

Farming is a profession of hope

Brian Brett

Farmer Thinking

The global food demand will sharply increase in 2050 to feed an estimated population of nine billion. At that time, agricultural extension will not be possible anymore because production has already reached sustainable limits in many parts of the world due to environmental degradation and climate change. Worse, in the name of immediate profits industrial agriculture is actually producing contaminated food and water, increasing atmospheric CO₂ by burning soil carbon, and decreasing soil fertility in the long term. Industrial agriculture has also deepened the social gap between the farmers from the countryside and the customers from the cities, leading to many food security issues. As cleverly foreseen by Montesquieu, we should never have ignored farmer thinking. The actual challenge of agriculture is therefore to be sustainable and ecological and to produce safe food.



On field discussions on a seeder adapted to direct sowing in tropical wet areas. © 2013 Magalie Lesueur Jannoyer

Agroecology

Agroecology is a scientific discipline that uses ecological theory to study, design, manage, and assess agricultural systems that are productive but also resource conserving, according to Altieri (http://nature.berkeley.edu/~miguel-alt/what_is_agroecology.html; Altieri 2012; Altieri and Nicholls 2012; Altieri et al. 2012). The main agroecological goals are thus to feed the world without degrading natural resources and to sustain productivity by optimizing ecological processes. These overall principles are developed for decision makers in the FAO Save and Grow reports for sustainable intensification of smallholder crop production (Food and Agriculture Organization 2011) and in the ONU special contribution of Olivier de Shutter (De Shutter 2011, 2012). The future of agriculture depends on how effectively we understand and manage both social and ecological factors. The science of agroecology involves by nature the study of the whole agrosystem. As a consequence, investigations must be multidisciplinary with contributions from all disciplines relevant to the farming system, such as biological, physical, and social sciences. The major breakthrough versus industrial agriculture is that agroecology does not rely solely on technical knowledge. Farmers and human networks are indeed considered central players of the system. As a consequence, the classical top-down directives are not efficient anymore. Alternatively, bottom-up, participatory, and codesign studies will lead to sustainable innovations that will be accepted by farmers and the public.



Cover crop trials in banana cropping systems. © 2013 Magalie Lesueur Jannoyer

Family Farming

2014 is the International Year of Family Farming. Most farmers worldwide practice family farming, which yields nearly 70 % of the global agricultural production. Family farming is a very good topic for agroecological investigations, because most of the time family farming involves the use of biological regulations in diversified production systems instead of monoculture and chemical solutions. Family farming also provides local knowledge and know-how accumulated over centuries. Family farming is also a good case for agroecological studies, because it involves interactions at various scales and organization levels, from individuals to communities and territories landscapes.

This book shows applications of agroecological principles. The overall finding is that farming diversification and mixed cropping systems lead to both ecological intensification of agriculture and to the mitigation of global change. Chapter 1 by Angeon et al. explains the design of agroecology with a focus on the connection of life with economic and social sciences to build sustainable systems. Chapter 2 by Preston and Rodríguez reviews the recycling of farm products into feed, food and fuel. Chapter 3 by Ratnadass and Barzman reviews advances for crop protection. Chapter 4 by Alexandre et al. focusses on animal science, which is usually overlooked in agroecology. Chapter 5 by Clermont-Dauphin et al. explains how to manage soil biodiversity to design new cropping systems. Chapter 6 by Boval et al. reviews alternatives for grasslands intensification in tropical areas. Chapter 7 by Valet and Ozier-Lafontaine reviews traditional farmer intercropping systems for free ecosystem services, with a focus on participatory and codesign research. Chapters 8 by Chave et al. reviews advances in biocontrol for soil pests. Chapter 9 by



Mixed cropping system: the example of the creole garden in the Caribbean. © 2013 Harry Ozier-Lafontaine

Archimède et al. reviews the potential of local tropical resources for livestock nutrition. Chapter 10 by Le Henaff and Cebesi highlights the need to remove language barriers for agroecological education. Chapter 11 by El Ramady et al. presents an exhaustive review of soil quality and plant nutrition. Chapter 12 by El Ramady et al. presents the advanced concept of micro-farms.

Petit-Bourg, Guadeloupe
Le Lamentin, Martinique
Dijon, France

Harry Ozier-Lafontaine
Magalie Lesueur Jannoyer
Eric Lichtfouse

References

Altieri MA http://nature.berkeley.edu/~miguel-alt/what_is_agroecology.html

Altieri MA (2012) Convergence or divide in the movement for sustainable and just agriculture. *Sust Agric Rev* 9:1–9. doi:10.1007/978-94-007-4113-3_1

Altieri MA, Nicholls CI (2012) Agroecology scaling up for food sovereignty and resiliency. *Sust Agric Rev* 11:1–29. doi:10.1007/978-94-007-5449-2_1

Altieri MA, Funes-Monzote FR, Petersen P (2012) Agroecologically efficient agricultural systems for smallholder farmers: contributions to food sovereignty. *Agron Sust Dev* 32:1–13. doi:[10.1007/s13593-011-0065-6](https://doi.org/10.1007/s13593-011-0065-6)

De Shutter O (2011) Agroecology and the right to food. <http://www.srfood.org/en/report-agroecology-and-the-right-to-food>

De Shutter O (2012) Agroecology, a tool for the realization of the right to food. *Sust Agric Rev* 8:1–16. doi:[10.1007/978-94-007-1905-7_1](https://doi.org/10.1007/978-94-007-1905-7_1)

Food and Agriculture Organization, “Save and Grow” initiative (2011) www.fao.org/ag/save-and-grow

Acknowledgments

This book was initiated in 2012 during the summer school entitled Functional Traits and Sustainable Mixed Cropping System Design organized by the INRA and the CIRAD in Martinique. The main issue was the application of agroecology in tropical areas. We thanks all the contributors and school attendees who improved our vision and who helped widen the field application of agroecology.

Contents

Agroecology Theory, Controversy and Governance	1
Valérie Angeon, Harry Ozier-Lafontaine, Magalie Lesueur-Jannoyer, and Arnaud Larade	
Food and Energy Production from Biomass in an Integrated Farming System	23
Reg Preston and Lylian Rodríguez	
Ecological Intensification for Crop Protection	53
Alain Ratnadass and Marco Barzman	
Livestock Farming Systems and Agroecology in the Tropics	83
Gisèle Alexandre, Audrey Fanchone, Harry Ozier-Lafontaine, and Jean-Louis Diman	
Cropping Systems to Improve Soil Biodiversity and Ecosystem Services: The Outlook and Lines of Research	117
Cathy Clermont-Dauphin, Eric Blanchart, Gladys Loranger-Merciris, and Jean-Marc Meynard	
Agroecology and Grassland Intensification in the Caribbean	159
Maryline Boval, Stéphane Bellon, and Gisele Alexandre	
Ecosystem Services of Multispecific and Multistratified Cropping Systems	185
Serge Valet and Harry Ozier-Lafontaine	
Agroecological Engineering to Biocontrol Soil Pests for Crop Health	269
Marie Chave, Marc Tchamitchian, and Harry Ozier-Lafontaine	

Agroecological Resources for Sustainable Livestock Farming in the Humid Tropics	299
Harry Archimède, Gisèle Alexandre, Maurice Mahieu, Jérôme Fleury, Dalila Petro, Gary W. Garcia, Audrey Fanchone, Jean-Christophe Bambou, Carine Marie Magdeleine, Jean-Luc Gourdine, Eliel Gonzalez, and Nathalie Mandonnet	
Agroecology for Farmers: The Linguistic Issue	331
Diane Le Hénaff and Zeynel Cebeci	
Soil Quality and Plant Nutrition	345
Hassan R. El-Ramady, T. A. Alshaal, M. Amer, É. Domokos-Szabolcsy, N. Elhawat, J. Prokisch, and M. Fári	
Plant Nutrition: From Liquid Medium to Micro-farm	449
Hassan R. El-Ramady, T. A. Alshaal, S. A. Shehata, É. Domokos-Szabolcsy, N. Elhawat, J. Prokisch, M. Fári, and L. Marton	
Index	509