



Eric Lichtfouse
Editor

SUSTAINABLE AGRICULTURE REVIEWS 3

Sociology, Organic Farming, Climate Change and Soil Science



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ISBN 978-90-481-3332-1 e-ISBN 978-90-481-3333-8
DOI 10.1007/978-90-481-3333-8
Springer Dordrecht Heidelberg London New York

Library of Congress Control Number: 2009941465

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Printed on acid-free paper

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

Contents

1 Society Issues, Painkiller Solutions, Dependence and Sustainable Agriculture	1
Eric Lichtfouse	
2 Sociology of Sustainable Agriculture	19
Ezatollah Karami and Marzieh Keshavarz	
3 Sustainable Versus Organic Agriculture	41
Juying Wu and Vito Sardo	
4 Organic Agriculture and Food Production: Ecological, Environmental, Food Safety and Nutritional Quality Issues	77
Reza Ghorbani, Alireza Koocheki, Kirsten Brandt, Stephen Wilcockson, and Carlo Leifert	
5 Sustainability of Energy Crop Cultivation in Central Europe	109
Volkhard Scholz, Monika Heiermann, and Peter Kauffuss	
6 Phosphorus, Plant Biodiversity and Climate Change	147
Nicole Wrage, Lydie Chapuis-Lardy, and Johannes Isselstein	
7 Co-evolution and Migration of Bean and Rhizobia in Europe	171
Paula A. Rodiño, Marta Santalla, Antonio M. De Ron, and Jean-Jacques Drevon	
8 Non-isotopic and ¹³C Isotopic Approaches to Calculate Soil Organic Carbon Maintenance Requirement	189
Francisco Mamani Pati, David E. Clay, Gregg Carlson, and Sharon A. Clay	
9 Soil Solarization and Sustainable Agriculture	217
Trifone D'Addabbo, Vito Miccolis, Martino Basile, and Vincenzo Candido	

10 Soil Functions and Diversity in Organic and Conventional Farming.....	275
Supradip Saha	
11 Indigenous Soil Knowledge for Sustainable Agriculture.....	303
Iin P. Handayani and Priyono Prawito	
12 Composting to Recycle Biowaste	319
György Füleky and Szilveszter Benedek	
13 Nematodes as Biocontrol Agents.....	347
Tarique Hassan Askary	
14 Allelopathy and Organic Farming.....	379
Jana Kalinova	
15 Occurrence and Physiology of Zearalenone as a New Plant Hormone	419
Jolanta Biesaga-Kościelniak and Maria Filek	
16 Homestead Agroforestry: a Potential Resource in Bangladesh.....	437
M. Giashuddin Miah and M. Jahangir Hussain	
Index.....	465

Chapter 4

Organic Agriculture and Food Production: Ecological, Environmental, Food Safety and Nutritional Quality Issues

Reza Ghorbani, Alireza Koocheki, Kirsten Brandt, Stephen Wilcockson,
and Carlo Leifert

Abstract Conventional agricultural systems should not only produce much greater amounts of food, feed, fibre and energy to meet the global needs, but also challenge problems to improve health and social well-being of man, reduce dependence on fossil fuels, adapt to climate change and extreme weather, reduce environmental degradation and decline in the quality of soil, water, air and land resources throughout the world as well. The present one-dimensional physical and chemical production systems should be replaced by an agricultural paradigm that rely more on biology, ecology and sociology, and meet global food needs based on the soil, water, land and fertility resources without compromising the capacity of future generations in meeting their environmental, food and resource needs. Organic agriculture as an alternative to conventional systems of food production should contain features of agricultural systems that promote the environmentally, socially and economically sound production of food and fibre, and aim to optimize quality at all levels. The underlying principles are to minimize the use of external inputs as far as possible and use of resources and practices that enhance the balance of ecosystems and integrate components of farming systems into an ecological system. Organic agriculture is developing rapidly and the organic land area is increased by almost 1.8 million hectares compared to the consolidated data from 2005. Worldwide, in 2006, over 30.4 million hectares were managed organically by more than 700000 farms, constituting 0.65 percent of the agricultural land of the countries surveyed. Recognizing the ecological principles, self-regulating

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E. Lichtfouse (ed.), *Sociology, Organic Farming, Climate Change and Soil Science*,
Sustainable Agriculture Reviews 3, DOI 10.1007/978-90-481-3333-8_4,
© Springer Science+Business Media B.V. 2010

77

ability and system stability, agro-biodiversity, climate change and global warming, soil nutrients and soil biology, erosion, nonchemical crop protection and generally agroecosystem health are the most significant ecological and environmental issues regarding production systems. Organic agriculture in farming, processing, distribution or consumption is to sustain and enhance the process of food safety and health at all stages and levels of the agroecosystem in order to prevent serious food safety hazards such as pathogens like prions (BSE), allergens, mycotoxins, dioxins, GMOs, pesticide residues, growth hormones, food additives like colorants, preservatives, flavours, process aids, nitrite added to processed meat, salt, added sugar and saturated fat. There are growing evidences suggesting that organic agricultural systems produce enough quantity and quality foods and have a number of ecological, environmental and health advantages for consumers over food from conventional systems.

Keywords Organic farming • Biodiversity • Climate change • CO₂ • Soil carbon • N₂O • Methane • Soil microbial biomass • Erosion • Food quality

4.1 Introduction

The intensification of agriculture in conventional production systems has resulted in major ecological, environmental and sociological, health and food safety problems in the recent decades. Low stability, climate change and global warming, decreasing biodiversity, accelerated soil erosion by wind and water, chemical fertilizers mainly nitrogen, phosphorus and pesticides in groundwater and on food, the pesticide 'treadmill' caused by development of pest resistance to pesticides, routine use of antibiotics for animals leading to antibiotic-resistant strains of organisms, pesticide contamination of farm workers and agroecosystem health are some examples of those problems. Additionally, an overreliance on grain crop monocultures and loss of crop diversity in the aftermath of the 'green revolution' has resulted in a loss of well-balanced diets (Magdoff 2007). On the other hand, the conventional approach of increasing dependence on off-farm inputs, including fertilizers, pesticides and energy for food, feed and fibre production, is of questionable sustainability resulting in environmental degradation. Therefore, development of alternative production systems that can preserve productivity and minimize the negative biological and environmental consequences and long-term sustainability problems associated with agricultural practices has a high priority in agriculture worldwide.

It is believed that organic agriculture addresses these public demands and has the potential to improve the agricultural system's biological functionality and diminish some environmental pollution aspects of agricultural production (Boer 2003; Dabbert 2003). The ecological, environmental and food safety and nutritional benefits of organic farming systems together with growing consumer demand for organic food in many countries, show that organic production systems might be appropriate and desirable alternatives to conventional systems (Poudel et al. 2002). The principal guidelines for organic production are to use materials and practices that enhance the