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Editors

Soil Enzymology in the Recycling of Organic Wastes and Environmental Restoration

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Preface

Soil biological and related biochemical parameters, particularly enzymes, play a fundamental role in many soil processes such as the mineralization of organic matter, the synthesis of humic substances, the degradation of xenobiotics or the mechanisms involved in the biocontrol of plant pathogens. Their direct link with soil microorganisms gives them a key role as biomonitors of the evolution of soil quality, in the determination of their resistance to or their resilience against external environmental impacts, or in the monitoring of the application of organic amendments in the recovery of degraded, eroded or polluted soils. As a consequence of the importance of soil biological and biochemical parameters on soil processes, there is an increasing interest in their study, as well as in the application of new biochemical and molecular techniques, which, when applied to soil, are becoming indispensable diagnostic tools.

It is especially important to assess the evolution of soil quality after the introduction into the soil of exogenous materials which are produced as organic residues in the domestic, industrial or agronomic human activities. This form of waste reutilisation is extremely important in the Mediterranean environment due to the depletion in organic matter content of its soils and the consequent risk of soil erosion and environmental degradation. However, the role of organic amendments in the recovery of soil biodiversity has the counterpart of an increase in the risk of environmental pollution due to an excess or inadequate balance of soil nutrients or the presence of organic and inorganic pollutants. In this book, numerous research papers are presented concerning the effects of organic wastes addition to soil as a consequence of its generalised use in Southern European agroecosystems.

The research on soil enzymology, which has developed in Spain since the 1980s, has achieved a notably high level of relevance. However, its importance has not been recognised in the public and institutional domain and these studies have not been taken into account in terms of environmental monitoring of soil, nor in the design of the management of organic residues, nor environmental restoration. Therefore, at the beginning of December 2008, the Spanish Group of Soil Enzymology organised an international meeting, held in Burgos (Spain), with the intention of disseminating the research in soil enzymology. As a consequence of

this event, at which more than fifty research papers were presented, a collection of the most relevant works have been collected, updated and reviewed in this book presenting interesting topics in the research of applied soil enzymology and related parameters such as microbial biomass quantisation or the use of new molecular tools in soil biochemistry.

The book is divided in three main sections: the first one is dedicated to the discussion of the role of enzymes as indicators in environmental monitoring, the second one deals with the application of soil enzymology and related biochemical parameters to environmental restoration processes, most of them involving the recycling of organic wastes, and finally, the third section tries to introduce new molecular tools or new applications of enzymes to other technological applications of organic residues.

The book has an introductory chapter written by Prof. Nannipieri et al., which is an up to date revision of the history of soil enzymology, the future challenges for it and the emerging tools in molecular ecology. Furthermore, the first chapter of each section contains a deep analysis of its main purpose. The first section addresses the role of enzymes and other biochemical properties in soil and ecosystem monitoring, the second section revises the effect of heavy metal pollution on microbial activity and the changes induced in the microbial community structure, and in the third one, new advances in molecular fingerprinting are applied to the study of microbial communities that play a significant role in organic wastes treatments, such as anaerobic processes.

The book also includes interesting studies about the behaviour of enzymes in contrasting soils, such as those of Mexican *tetapetes*, andosols from the Canary Islands, minimally disturbed Mediterranean soils of Catalonia, grassland soils or eucalyptus plantations from Galicia or fire affected soils. Two chapters are related to the study of humus-enzyme complexes and the information that they give about soil quality or more general aspects related to soil biochemical properties such as the influence of pre treatments of soil samples and their influence in the consequent interpretation of the results.

In section two, after the general introductory chapter, particular aspects are included in several chapters such as the effect of heavy metals on soil enzymes in soils contaminated after Aznalcollar spill (Seville, Spain) or agricultural soils contaminated with Zn. Other chapters are related to the effect of xenobiotics on soil enzymes such as those dedicated to study the effect of 2,4,5-trichlorophenol, Banvel or mixture of herbicides like oxyfluoren and glyphosate. Finally, the use of organic amendments in restoring degraded soils are treated in three different chapters: one of them is about the recovery of a forest nursery field soil using several organic amendments, another is the recovery of gypsiferous soils with deinking paper sludge, alone or co-amended with other organic residues, and, finally, the middle term effect of the use of compost of sewage sludge to agricultural soils in Catalonia.

The third section concludes the book with chapters dedicated to the study of the extraction and characterisation of humus-enzyme complexes in vermicompost, the characterization of L-glutaminase in compost of urban refuse, the effect of dry

olive residues, after a fungal treatment or not, in the rhizosphere soil of lettuce and finally, the effect of biodisinfection processes on soil microbial populations.

The editors are grateful to Springer and to Ms. Oelschlaeger for the interest shown in publishing the results of this International Conference and to Springer Publishing Group for its help in the production of the book.

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