

Editorial

Soils and waste management: A challenge to climate change

This Special Issue of Waste Management is dedicated to selected contributions presented at the international workshop: “*Soils and waste management: a challenge to climate change*”, held on 15–16 June, 2006 in Gorizia (Italy) and co-sponsored by the Cooperative Research Programme: Biological Resource Management for Sustainable Agricultural Systems of the OECD. The aim of the workshop was to focus on the opportunities for combining the role of soil and waste management in the context of strategies and policies aimed to counteract the negative effects of climatic change.

Currently the potential threat of climate change represents one of the main environmental concerns worldwide. Consequently, most of the developed countries are implementing measures at different levels in order to tackle greenhouse gas (GHG) emissions. Amongst the measures agreed internationally and encapsulated within the Kyoto Protocol, the reduction of GHG emissions associated with agriculture and organic waste management, and the enhancement of the C sink capacity of agricultural soils are seen to be of particular importance.

Soil organic matter content and quality plays a key role in the reduction of GHG emissions derived from agriculture. Soil organic matter fulfils several important functions in determining soil fertility such as improving its physical properties, supplying nutritional elements and enhancing their uptake, providing the substrate for microorganisms, regulating the cycling of a range of important elements, protecting crops from certain plant diseases and reducing the adverse effects of xenobiotics. An appropriate amount of organic matter in soil contributes to energy saving by reducing the need for soil tillage and irrigation and decreases the use of fertilizers and pesticides, which reduces the GHG emissions associated with agriculture. In addition, a recovery or an increase in soil organic matter content by either appropriate soil management or the addition of organic amendments results in the sequestration of some atmospheric C in the soil for a relatively long period, thus reducing the CO₂ released into the atmosphere.

Waste management can also play an important role in reducing GHG release. Both waste management and dis-

posal are responsible for the production of a significant amount of GHG, especially CO₂, CH₄ and N₂O, contributing to global warming. This is a major problem considering the amount and dynamics of waste production worldwide. The available options for waste management could have very different impacts on global warming, not only by a direct decrease in GHG emissions, but also indirectly by saving energy and materials from non-renewable resources. The choice of the more appropriate waste management option requires consideration not only of the direct effect on GHG emissions, but also the economic and environmental aspects of such management.

The use of organic wastes as soil amendment is a “win-win” strategy since, besides the direct reduction of GHG emissions associated with waste treatment or disposal, it also brings benefits related to the increase in soil organic matter. Soil C sequestration leads to the saving of energy and non-renewable resources, to an increase in soil fertility and ultimately to a better environment.

Despite the fact that many studies have shown the relevance of appropriate soil and organic waste management in reducing GHG emissions, further research work is required to provide a better knowledge base to support the development of more effective environmental policies. In particular, the potential of C sequestration in agricultural soils is becoming a priority research area in countries around the world, especially after the UNFCCC meeting at Bonn (2001) that included land management systems as allowable terrestrial C sinks. However, soil C sequestration has not been included, for the time being, in the recent “Emission Trading Scheme” (Directive EU 2003/87) that regulates the trading of C credits in Europe. This scheme only considers long-term emission abatement improvements, and organic C stored in soil is only considered to be sequestered if it remains locked up in the soil for at least 100 years. Hence, to include soil C sequestration in the international C credit trading scheme it is necessary to have a better understanding of the processes affecting soil organic matter and the different C pools in the soil. This information would allow a more precise evaluation of the amount of C that remains in the soil, in the long term, following changes

in soil management strategies under different climate and environmental conditions. The argument for using a much shorter storage horizon than 100 years also needs to be examined, and this data would help to support that work.

These research and policy needs, which were the main driver for the organisation of the OECD Workshop, were addressed during the workshop. The outputs are reflected in the selected scientific papers presented in this special issue of *Waste Management*.

The first set of papers dealt with the significance of appropriate soil and waste management options in terms of the sustainability of agriculture and environmental protection.

A second group of contributions described policies and constraints regarding soil protection and sustainable waste management in the European Union and in developing countries. In particular, it was shown that in developing countries changes in waste treatment performance, in terms of GHG offset per unit weight of organic residue, could represent an opportunity to attract foreign investment to improve the current waste management infrastructure.

Another set of papers was concerned with the chemical and microbiological mechanisms regulating GHG emissions and soil C sequestration. Examples demonstrated how GHG production from organic residues might be reduced by regulating microbial processes. Other manuscripts underlined the importance of having better knowledge of chemical and microbiological mechanisms regulating endogenous and exogenous organic matter dynamics in soil. These processes have important implications in our understanding of C mineralisation in soil, a fundamental process in the sequestration of soil organic C. Special attention was paid to the humification processes leading to the long-term immobilisation of organic carbon in the soil.

The fourth group of manuscripts dealt with the definition, significance and correct evaluation of soil C sequestration and comparison of the GHG budgets for different waste treatment options. A particular focus was on the comparison, in terms of GHG reduction and environmental impact, of the utilisation of carbon-rich residues either for bioenergy production or for C sequestration.

The last set of contributions was dedicated to the impact of the addition of organic wastes on soil fertility and quality, and to practical approaches for organic waste management, with particular emphasis on innovative waste treatments and new types of wastes. For instance, a reduction of GHG emissions was achieved in the case of pig farms by the adoption of simple and novel operational changes. The low rate of degradation of two-phase olive mill wastes, both during composting and after soil application, makes the use of such organic wastes an attractive option for the implementation of a soil C sequestration strategy.

One of the main outputs of the workshop was the significance of the integration and coordination of soil and organic residues management in tackling GHG emissions and in assuring the sustainability of agricultural systems. In addition, it was pointed out that by combining the management of soils and waste in an integrated way we can increase soil C sequestration and this will have wider environmental implications than just focussing on GHG emissions reduction. Soil organic matter content and properties are fundamental in defining the quality of soil, a non-renewable resource that needs to be protected and enhanced. Nevertheless, soil organic matter content in recent decades has shown a continuous decrease in many parts of the world leading to a decline in soil fertility and environment quality, which threatens the sustainability of current agricultural systems to meet the food and fibre needs of the increasing world population. Recovery of soil organic matter in poor and degraded soil through effective soil and waste management is essential. This will not only have positive effects on climate change, but will also protect and improve the environment and help to guarantee the sustainability of agricultural systems.

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