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A Review

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Biochar - A breath for soils

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Introduction

The inspiration for the supplementation of soil with charcoal stems from observations made in the ancient agricultural management practices that created *Terra preta*, deep black soils. These soils, found throughout the Brazilian Amazon, are characterised by high levels of soil fertility compared with soils where no organic C addition occurred (Harder, 2006; Marris, 2006; Lehmann, 2007 and Renner, 2007). One area in the renewable energy renaissance attracting significant attention is the use of biochar produced from the pyrolysis of vegetative biomass. One potential abatement strategy to increasing atmospheric levels of carbon dioxide (CO_2) is to sequester atmospheric CO_2 captured through photosynthesis in biomass and pyrolysed into a more stable form of carbon called biochar. Properties of biochar vary widely, depending on the biomass source used and the conditions of biochar production (Lehmann and Joseph, 2009). Biochar can be produced from a wide range of biomass materials; from forest residues and post-consumer wastes to purpose-grown crops. To ensure that there are no adverse environmental effects from production of biochar, the feedstock should be obtained from sustainable sources and utilisation shall contribute to climate change mitigation by reducing GHG emissions (compared to fossil fuels) and converting labile carbon into more stable forms of carbon. A basic framework for biochar classification has been proposed by Joseph *et al.* (2009). Bio char has the potential to alter significantly soil-crop interactions through various physical, chemical and biological properties that drive these interactions are surface area, surface groups pore size distribution and water retention capacity of biochar. These properties can affect nutrient availability, water and agricultural chemicals in the soil. In addition, the presence of biochar in soil offers a high surface area, protected and substrate rich environment supporting the growth of soil microbial populations. These properties are dependent upon biochar feed stock and production conditions. Biochar is known to increase nutrient availability, microbial activity, soil organic matter, water retention, crop yields, decrease fertilizer needs, greenhouse gas emissions, nutrient leaching, erosion and adverse soil temperature effects under dryland agriculture.

Biochar is a stable carbon (C) compound created when biomass (feedstock) is heated to temperatures between 300 and 1000°C, under low (preferably zero) oxygen concentrations. The objective of the biochar concept is to abate the enhanced greenhouse effect by sequestering C in soils, while concurrently improving soil quality. The proposed concept through which biochar