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Biochar-Acid Soil Interactions—A Review

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Abstract
Soil acidity is a major problem of agriculture in many parts of the world. Soil acidity causes multiple problems such as nutrient deficiency, elemental toxicity and adverse effects on biological characteristics of soil, resulting in decreased crop yields and productivity. Although a number of conventional strategies including liming and use of organic and inorganic fertilizers are suggested for managing soil acidity but cost-effective and sustainable amendments are not available to address this problem. Currently, there is increasing interest in using biochar, a form of biomass derived pyrogenic carbon, for managing acidity while improving soil health and fertility. However, biochar varies in properties due to the use of wide diversity of biomass, variable production conditions and, therefore, its application to different soils can result in positive, neutral and or negative effects requiring an in-depth understanding of biochar-acid soil interactions to achieve the best possible outcomes. Here, we present a comprehensive synthesis of the current literature on soil acidity management using biochar. Synthesis of literature showed that biochars, enriched with minerals (i.e., usually produced at higher temperatures), are the most effective at increasing soil pH, basic cation retention and promoting plant growth and yield. Moreover, the mechanism of soil acidity amelioration with biochar amendments varies biochar types, i.e., high temperature biochars with liming effects and low temperature biochars with proton consumption on their functional groups. We also provide the mechanistic interactions between biochar, plant and soils. Altogether, this comprehensive review will provide guidelines to agricultural practitioners on the selection of suitable biochar for the reclamation of soil acidity.

Author Keywords
biomass; crop yield; nutrient availability; pH buffering; pyrogenic carbon; soil acidity

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