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Editorial

Biochar: A Tool for Improving Soil Fertility

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Sustainable agriculture is a main concern at present all over the world. Soil fertility is vital for sustainable agriculture. Continuous soil cultivation has resulted in several problems including soil degradation, soil acidification, depletion of soil organic matter, as well as soil erosion. Soil organic matter depletion can also result in the decreased aggregate stability. Composts and manures are usually applied to arable lands to get benefits of adding nutrients and organic matter for improving soil fertility. However, most of manures and composts contain heavy metals and pathogens which are contaminants for agricultural lands and thereby decline soil fertility. Furthermore, manures can also substantially release greenhouse gases (CO_2, CH_4 and N_2O) into atmosphere causing global warming. Therefore, it is essential to counteract soil degradation by sustainable methods and strategies.

Biochar has been proven a renewable resource and eco-friendly material for improving soil fertility. Biochar is an organic material produced from biomass under high temperatures of pyrolysis in the absence or depleted oxygen. Biochar is a carbon rich material with a plenty of porous structure and functional groups. The high specific surface area of biochar has the potential to bind heavy metals. Application of biochar loaded with nitrogen and phosphate fertilizers could be also a great source to improve soil fertility by be a slow-release of fertilizer to soil. It also has been documented that biochar possesses fulvic and humic organic substances. It also provides habitats for a variety of microorganisms which are beneficial for soil fertility. The elemental composition of biochar generally include carbon, nitrogen, hydrogen, and some lower nutrient element, such as K, Ca, Na and Mg.

Biochar can improve soil fertility and crop production by several mechanisms. An overview of biochar mechanisms for improving crop productivity has been shown in figure 1. Many studies have revealed that application of biochar to soils could improve soil structure, increase porosity, decrease bulk density, and enhance aggregation and water retention. Besides, biochar has also been reported to reduce soil acidity, while increase soil cation exchange capacity. Soil microbial diversity, structure and community composition has also been reported as affected by biochar amendment.

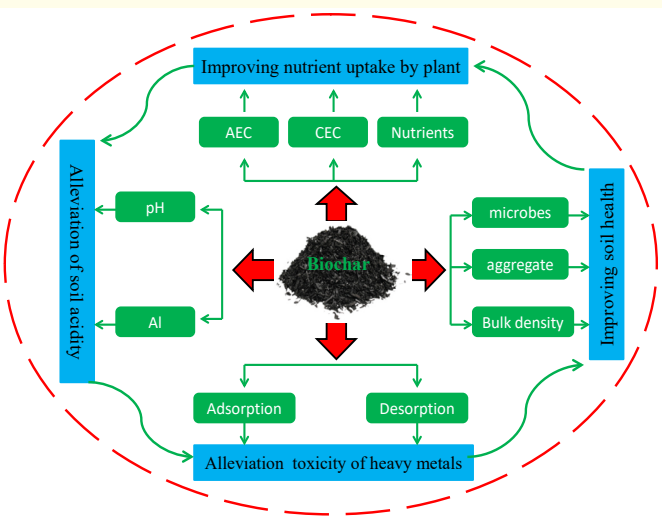

Figure 1: Biochar mechanisms for improving soil fertility.

The soluble nutrients in biochar and mineralization of labile organic matter of biochar can be a great source of essential elements for plants. Biochar can also reduce nutrient leaching because of its unique properties. Biochar can decrease N losses (N2O and ammonia) in soils through influencing denitrification. In short, the mechanisms of biochar in the improvement of soil fertility include (i) biochar effects on soil physical and chemical properties, (ii) biochar as a source of nutrients, (iii) biochar effects on soil biota and (iv) biochar effects on soil adsorption and desorption of nutrients. However, it is important to comprehend the mechanisms which may induce changes in soil fertility following biochar application into soil [1-3].

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