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Progressing from Terra Preta de Índios to the Whole World

Variability of biochar properties - implication for usage and sourcing of materials

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Introduction

The term 'biochar' is used as a general term to describe the charred product resulting from pyrolysis. However, the physico-chemical characteristics of biochar vary widely depending on feedstock and pyrolysis conditions.

As part of two national biochar projects in Australia (GRDC, DAFF funded), our work has created an inventory of biophysical and chemical characteristics of more than 70 different biochars derived from a wide range of feedstocks and produced under various pyrolysis conditions.

Results and Discussions

Using multivariate analysis, we explored the impact of feedstock and pyrolysis conditions on the over-all characteristics of biochar.

Analysis demonstrated considerable variability in the physico-chemical characteristics of biochar products, and indicated that feedstock (e.g. manure, wood, food-waste) was the primary determinant, with pyrolysis conditions (HTT, heating rate) having a more subtle impact.

With regard to nutrient content (N, P, K) associated parameters (cation exchange capacity, pH, water-holding capacity) wood-derived biochars demonstrated surprising variability, while manure-derived biochars were relatively similar to one another. It might be expected that wood-waste derived from oil mallee, or from oak, in a similar form (e.g. sawdust vs. cuttings) would be relatively homogenous, yet variability in nutrient composition was evident.

Manures are inherently heterogeneous materials depend on animal production and the type of bedding material used. Although nutrient content was rich and relatively consistent, the heavy metal content of the manure-based biochars proved highly variable. Further work is required to assess the bioavailability of the heavy metals.

Conclusions

Our work demonstrates that the physiochemical properties of biochar varied primarily as a result of feedstock, with pyrolysis conditions having a smaller secondary influence.

The biochar inventory demonstrates wide variability in the physico-chemical properties of biochars, and provides a unique resource to address how biochars of contrasting properties interact with the soil environment.

Characterizing the physico-chemical nature of biochar is fundamental to interpreting research results and in working towards developing guidelines for biochar application to benefit agricultural production.

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