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Progressing from Terra Preta de Índios to the Whole World

Characterisation for commercialisation: What the consumer needs to know

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Introduction

Some businesses around the globe are currently marketing biochars without any quality control measures; either for sourcing of feedstock or product. To maintain the credibility of this fledgling industry, the development of a simple classification system for biochars and biochar composites that meets the needs of both consumers and producers is urgently required.

Results and Discussions

Previous publications (Lehmann and Joseph 2009, ANBZ 2009) and discussions at meetings and conferences have resulted in a number of approaches to the classification and testing of biochars. Some scientists have emphasised tests to determine the recalcitrance of the biochars, in response to an interest in long-term C sequestration potential, while others have focused on specific surface properties, as these may have important implications in the retention of nutrients in soils. However, these properties while crucial for a scientific understanding of biochar, do little to build consumer confidence in the product.

This paper takes a different approach in that we are asking the following questions from the consumer's perspective.

Are there tests or guidelines that can determine?

1. If and when a specific biochar will improve the yield of a specific crop (s) for a specific soil(s).
2. If a biochar will result in detrimental impacts when applied to soil, such as inhibited germination, phytotoxicity, or reduction in earthworm population.
3. The long term effect of biochar(s) in the target soil.
4. Are there contaminants in the biochar that will impact either human health, soil health or impose trade barriers or restrictions on agricultural produce
5. If the feedstock has been sourced sustainably.

Table 1: Ecotoxicological assessment of biochar

Required analysis	Recommended method	Minimum criteria to be termed biochar (or notes)
Earthworm avoidance	Toxicity testing conducted using (OECD) earthworm avoidance method (OECD, 1984) as described in (4] *Biochar is applied into OECD standard soil at a rate of 1% w/w, with 10 replicates.*	Biometrical analysis against controls should show no biometrically significant earthworm avoidance to the biochar treatment.
Germination inhibition assay	Germination inhibition is tested against three test species using OECD standard soil (OECD 2004). [5]	Biometrical analysis against controls should show no biometrically significant decrease in plant germination.

It is proposed that a minimum set of information be provided when the biochar is sold. This includes ;

1. A statement of plant available nutrients (Lehmann and Joseph, 2009; Yao et al, 2010),
2. Recommendation of how to transport, store apply
3. Recommended application rates for different types of crops and/or different types of soil,
4. Indication of water holding capacity and,
5. For some applications, the ability to sorb toxic substances.
6. Results of ecotoxicity tests and if from waste compliance with local heavy metal content.

A range of possible simple tests to determine biochars effectiveness in different soils will be illustrated during the presentation. These test are based on a range of chemical, biological and physical factors that have influenced crop production in over 200 field plots in Australia, The tests also reflect the changes that occur during the growth and fallow periods over a 5-20 year period. They include simulated biogeochemical weathering (Yao et al., 2010), dissolution tests and changes in soil redox following biochar addition.

It will be recommended that ecotoxicological assessments need to be undertaken (Table 1). These tests will not guarantee the biochar has a positive influence on crop performance; however, they will assess any potential harm a poorly-produced biochar may impart in soil. Details of other simple tests that can be carried out in at the point of manufacture to determine quality and consistency will be discussed.

Current guidelines for similar products should be met such as those laid out in Table 2 for compost (EPA, 2010). Within the Australian context It is anticipated biochar should meet Grade A standards for application above 10t/ha. Grade B standard of heavy metal contamination may be adequate for lower application rates, or for non-food soil amendment.

Conclusions

The consumer is asking whether biochar will work and what are the risks associated with its application. Guidelines for safety of production and emissions from production are outside the scope of this paper and are subject to individual countries' legislation.

The biochar industry would be wise to adopt guidelines developed by the biofuels industry for sustainable sourcing of biomass (*Version Zero, Standard for Sustainable Biofuels, 2008*).

Table 2. Metal Contaminants Guidelines

Contaminant acceptance threshold NSW EPA230800d (EPA compost guidelines 2009)		
Contaminant	*Grade A mg/kg total*	*Grade B mg/kg total*
As	*20*	*20*
Cd	*3*	*5*
Cr	*100*	*250*
Cu	*100*	*375*
Pb	*150*	*150*
Hg	*1*	*4*
Ni	*60*	*125*
S	*5*	*8*
Zn	*200*	*700*

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