Introduction to biochar

Information sheet

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What is biochar?

Biochar is a fine-grained and porous form of charcoal that is specifically made for use as a soil improver. Added to soil, it can help to boost soil health, with positive benefits to plant growth and disease resistance. It combines a rediscovery of ancient Amazonian fertility-building techniques with a British gardening and turf-building tradition of using 'horticultural charcoal.' It is now the subject of academic research which will establish its potential to support reduced fertilizer use, reduced irrigation and increased yields. Because it supports higher levels of microbiological populations it can be a particularly valuable soil amendment for organic growers. It remains in the soil for centuries. It is therefore an investment in long-term fertility. The benefits of an initial application to soil structure and fertility increase over the years.

What does it do in the soil?

Biochar is being extensively researched at universities and research establishments around the world. Initial results already suggest a range of benefits, which will vary depending on soil type, climate and crop being grown. These benefits include accelerated plant growth, reduced input requirement, reduced irrigation and greater disease resistance, arising from

Soil biota

Biochar's porosity provides a safe habitat for beneficial soil microorganisms such as mycorrhizal fungi and actinomycetes bacteria (abundant in worm casts). These microorganisms are food for mites, protozoa, nematodes and other soil biota, particularly when soil is disturbed by ploughing or rotovation. The porous cavities of biochar provide a refuge for these desirable fungi and bacteria. Biochar helps keep microbiological populations at a higher level, while simultaneously reducing the rate at which soil gives off greenhouse gases.

Mineral retention

Biochar has a weak cation exchange capacity that helps keep dissolved nutrient minerals from being leached from the soil by rain or irrigation. By keeping minerals in the upper layers of soil they encourage more nutrient availability to plants. This leads to reductions in the usage of fertility inputs with consequent cost savings. Activated charcoal is not a substitute for biochar – its high cation exchange capacity can lock up nutrients, reducing their availability to plants.

Water retention

Biochar's porosity traps water and therefore delays drying out of soils and composts in which it has been incorporated. Trials have shown this can save as much as 50% on irrigation costs. The concentration of microbial life within biochar also supports greater moisture retention

Soil structure

A soil that has a high population of mycorrhizal fungi will benefit from their production of glomalin, a substance which assists soil particle agglomeration, giving it structure and reducing the escape of stored soil carbon. By encouraging fungal growth, biochar indirectly supports improved soil structure.

How is biochar made?

Biochar is made by pyrolysis, the technology whereby charcoal is made. Pyrolysis occurs when woody biomass is heated to high temperatures and the oxygen supply is closed off. The carbon content of the woody biomass cannot combust without oxygen, so it is reduced, by thermal decomposition, to biochar, a form of charcoal. The carbon in biochar retains the porous cell structure of the original feedstock material.

How is biochar used?

Biochar can be used in numerous ways:

1. As a one time soil amendment, at levels ranging from 400g to 2Kg per square metre
2. As a top dressing for shallow rooted plants (grasses, cacao trees)
3. As a seed compost ingredient at a level of 1 Kg per 20 litres compost
4. As an additive when composting
5. A sprinkling of biochar will minimize transplant shock with trees, shrubs and vegetable plugs

Who's using biochar now?

Trials are underway at (* = SA Certified):

Daylesford*– good results on polytunnel crops, now ordering in 1000 litre bags
Fairlight Hall* – 2 acre walled garden and soft fruit cages
Stonelynk Orchard* – Peach yields increased, field veg trials ongoing,
Delfland Plants* - performed as well as Klassman seed compost
Alnwick Castle – positive results
Easton Walled Gardens – Lady Ursula Cholmondeley now an enthusiast
Ben Raskin (Independent grower) - initiating trials with winter vegetables autumn 2011

Further trials to be initiated Autumn 2011 at the following sites:

Fir Tree Community Growers*
Scilly Organics*
Teybrook Farm*

UK Suppliers of biochar

Carbon Gold: 'GroChar (biochar enhanced with mycorrhizal fungi, wormcasts and kelp), GroChar seed compost, GroChar multipurpose compost www.carbongold.com

Oxford Biochar: Biochar; biochar compost; biochar growbags www.oxfordbiochar.com

Peat free opportunity

There is strong pressure to eliminate peat from all horticulture. The Government has set a deadline of 2020 for its removal from gardening products. Peat is composed of lignin and other carbon compounds that are produced by the decomposition of vegetable matter in the absence of oxygen, where water restricts oxygen supply. When peat is mined methane is released. Once applied to soil, the carbon content of peat finds its way back into the atmosphere as CO2. By combining the stable carbon of biochar with the carbon compounds found in materials such as compost, coir or composted green waste, growing media with comparable performance characteristics to peat can be produced, but with lower greenhouse gas emissions. Biochar inhibits soil greenhouse gas emissions and is stable in the soil for 1000 years or more.

Soil Association standards have further restrictions than EU Regulation 2092/91 regarding the use of peat as a soil conditioner. Effectively, it may be used only in propagating media.

EU Regulation permits peat for use in horticulture (market gardening, floriculture, arboriculture, nursery). Organic production using biochar without the use of peat could provide a marked point of difference in the market for produce

Further reading:

The Biochar Debate – James Bruges – Shumacher Briefing, Green Books
Biochar for Environmental Management – Lehman & Joseph – Earthscan Publications
Biochar Solution: Carbon Farming and Climate Change – Albert Bates – Foreword by Vandana Shiva, New Society Publishers