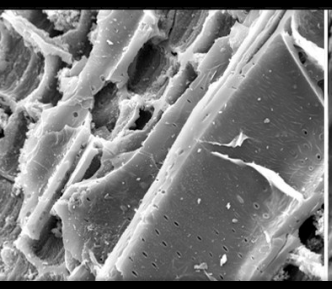
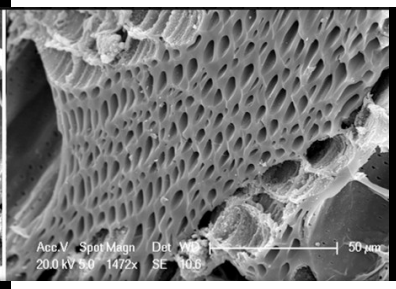
Issue 2

October 2015

British Biochar News





BRITISH BIOCHAR FOUNDATION

The European Biochar Cooperation on Science and Technology (COST) Conference, Germany, September 2015

Biochar has a plethora of uses and can be used to alleviate environmental problems in many different sectors. Biochar has positive effects on poor soils, in horticulture and in animal husbandry. Recently, other uses have been explored including the use of biochar to remediate soils, to cycle nutrients from sewage systems and even in building materials. All of these uses were discussed at the International conference and the main points are summarised here.

The application of biochar to temperature soils in the UK has had varying results. A number of studies have shown that pure biochar additions does not cause a negative response in crops, but also often does not increase the total biomass yield of crops significantly. This is not terrible news however, as in one study presented, although total biomass yield was not increased total grain yield was significantly improved, highlighting the way positive results can be hidden by common academic reporting of experimental results. Research across the world has shown that the addition of biochar has a greater visible effect on crop yields when it is added to already poor soils. Many soils in the UK are good quality and well fertilised and therefore the addition of biochar does not have a marked effect. This is not to say that adding biochar, improving the soil organic matter, improving the soil microbe communities and sequestering carbon is not a good thing, just that the visible effects that farmers need to make the product viable is not always present in temperate soils. In fact it was shown that in an analysis of 32 European field trials that a negative effect of biochar application occurred in only 6% of the treatments. Positive effects were observed in 12% of the cases, whilst no effect was observed in 80% of the cases. The biochar industry in the UK therefore needs not be unduly concerned by negative impacts of biochar application, rather to target biochar more precisely for specific purposes and think again about adding biochar by itself.

Stephen Joseph presented a very interesting perspective on the viability of biochar production and use in different farming situations across the world. He provided an example of a farmer's great success using targeted biochar application for avocado production in a salt affected, dry and highly weathered soil in Western Australia. Also of interest was the case of farmers who are incorporating biochar into cow feed and using dung beetles to bury the biochar-rich manure into the soil, which results in longer persistence of the organic matter over time, improving soil quality.

In this Issue:

"Committed to the sustainable development and deployment of the biochar industry in the UK"

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"biochar should be added to nutrients before it is added to the soil"

"Biochar can therefore be used as a way of increasing efficiency of the nutrients applied."

Stephen, along with Gerald Cornelisson, Hans-Peter Schmidt and other researchers have found that biochar should be added to nutrients before it is added to the soil. For example, manure, NPK or animal urine should be added to biochar before it is added to the soil. This infuses nutrients into the porous biochar structure and creates a slow release fertiliser. One problem with adding NPK or slurry directly to farmland is that the nutrients readily leach through the soil. This problem not only decreases the nutrient efficiency and reduces economic gain, but also pollutes the nearby rivers causing excessive growth of algae and bacteria, depriving water-dwelling animals and plants of oxygen (eutrophication). Adding these nutrient-rich substances to biochar decreases the leaching of the nutrients contained within. **Biochar can therefore be used as a way of increasing efficiency of the nutrients applied.** Research also shows that **the addition of biochar should be targeted** to the area where it is most needed. Adding it to the area just under the seeds (banding) has proven very successful.

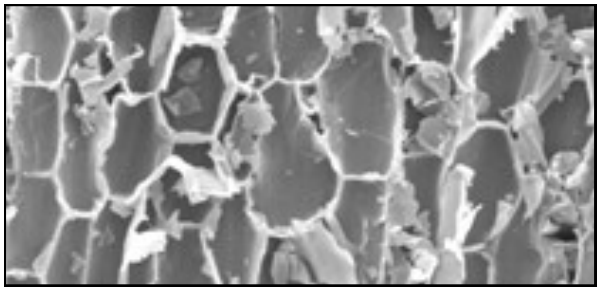
Farms in the UK may like to try these techniques:

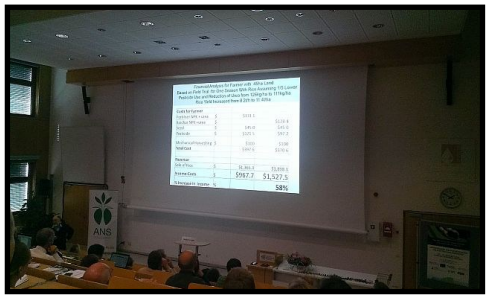
- Infusing the biochar with manure, animal urine, slurries, digestates or NPK before adding it to the soil.
- Targeting the biochar by adding it to the seedling areas. Either biochar products will need to be formulated to be compliant with current agricultural technologies, or innovation in agricultural engineering is going to be required to enable these targeted applications.

Another way that the farm might consider recycling and optimising the use of added nutrients is by making the biochar themselves using either the Exeter Retort, Kon Tiki kiln or CarbonCatcher™ kiln which are all available in the UK now. The BBF's Newsletter 1 (August 2015) presents information about all three technologies and for convenience we add contact details below.

All of these technologies can use waste woody / cellulosic substances and produce biochar in a day in quantities ranging from 10's of kg's to 100's of kg's. It is also possible to use other biomass in these kilns.

It is widely agreed that biochar which is made correctly, where the gasses and tars are not permitted to re-condense on the biochar during production, does not pose a risk to soils from an organic contaminant perspective. It is easy to tell when this contamination happens – your char will smell. Researchers have proven that heating biochar contaminated in this way, letting it mature in air over a period of months or composting it can render the char safe to use. Biochar can even be used to immobilise organic and heavy metal contaminants in soils, just another of the many benefits of using biochar.





Exeter Retort:

Contact Robin Rawle on 07515 683908 or Geoff Self on 07966 681676 or

email: admin@carboncompost.co.uk

Kon Tiki kiln:

Contact Richard Copley, richardcopley89@yahoo.co.uk

CarbonCatcher™

Contact David Friese-Greene, davidfg@netgates.co.uk, www.carboncatcher.co.uk

The European Biochar Cooperation on Science and Technology (COST) Conference, Germany, September 2015

"good substitute for peat in horticulture"

"Research has found that biochar in the animal feed can reduce the occurrence of illness in cows and also reduce the smells in the cattle shed."

'By substituting some concrete with biochar the carbon footprint of the concrete production is decreased."

Biochar and horticulture:

Biochar and char from hydrothermal carbonisation (HTC), which is a process that takes place under pressure with water at temperatures lower than pyrolysis (180-300°C), has been seen to be a **good substitute for peat in horticulture.** Research from the Freie University Berlin and University of Oldenburg suggest that the production of biochar-composts and biochar-fertilisers, or the use of biochar as a nutrient carrier and nutrient storage medium shows a promising approach to closed-cycling of nutrients and materials at the regional / local scales. This requires integrating biochar with sustainable biomass and organic waste management. Pure addition of biochar or HTC-char can inhibit plant growth. However, co-composting of char resulted in positive effects during the composting process itself (reduces bad odour and greenhouse gas emissions) and showed positive effects on plant growth. Biochar / HTC-char – compost mixture proved a promising horticulture substrate and could be used as a peat substitute.

In the strawberry industry, research has shown that there are fewer waste strawberries when the crop is grown in biochar-amended soils. Other research that shows a decrease in disease in plants grown in biochar-amended soils supports this finding. The growth of *Populus* (poplar) trees increased by 15% when grown in biochar compost soils compared to control soils according to research undertaken at the Botanic Garden of Berlin. Studies from the Research Institute of Horticulture in Poland showed an increase in peach yield with biochar additions. **Biochar therefore may have some positive effects on yields in horticulture and fruit crops when added with compost.**

Biochar and animal husbandry:

Research presented at the conference concurs with the research of Hans-Peter Schmidt on the cascading use of biochar. Charcoal has been fed to cattle and animals by vets for years to reduce the effect of the ingestion of toxic matter. **Research has found that biochar in the animal feed can reduce the occurrence of illness in cows and also reduce the smells in the cattle shed.**

Further nutrient cycling:

A study has shown that biochar can take up ammonia from waste piles e.g. urine patches in cattle sheds. This ammonia is then available to plants as ammonium when added to the soil, thereby recycling the nutrients and reducing the release of polluting gases from these waste patches, e.g methane. **Biochar can recycle nutrients on the farm.**

Biochar and concrete:

Another use of biochar is in the addition of the material to concrete. 1 tonne of concrete manufacture produces 1 tonne of CO_2 production. **By substituting some concrete with biochar the carbon footprint of the concrete production is decreased.**

Concrete can collapse when exposed to fire as the water contained in the material turns to gas and explodes the material. Researchers tested if the biochar added to the material could absorb the water during a fire and prevent destruction of the material. They found that during a fire in a tunnel made of biochar concrete less material was destroyed than in a tunnel made with just concrete. Also they found that the pollutants from cars in a tunnel (N_2O, NO) were reduced by the biochar and the smells were significantly reduced. They found that they could add 40kg of biochar to a meter cube of concrete without compromising the structural integrity.

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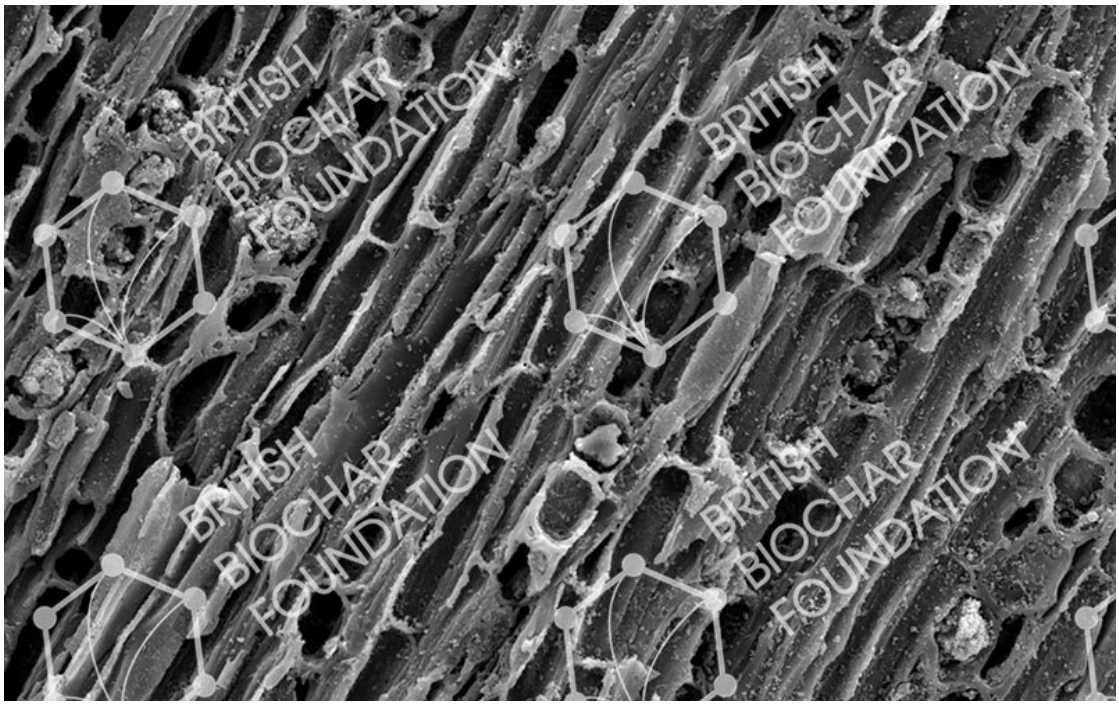
Uncertainty of Biochar stability in soil – technical review

One topic which still proves challenging with high uncertainty and room for speculation is the stability of biochar in soil. One of the key aspects of biochar application is its recalcitrance which is assumed to lead to long-term persistence in soil and which made biochar a tool for carbon sequestration and enable it to provide long-term positive effects in soil. However we need to be certain about its persistence in soil if biochar is to secure commercial or policy benefits arising from its recalcitrance. Many incubation studies have been conducted, the longest over around 10 years, with various estimations of **mean residence times, ranging from decades to centuries, when extrapolated from lab-based studies**. Priming (the term describing the effect of biochar on degradation of the existing carbon pool in soil) has been investigated intensively with positive and negative effects observed. Different models for extrapolation of lab data are used, assuming a different number of differently stable carbon pools within the biochar matrix which has marked effects on the outcome. In addition, lab studies are conducted under optimised conditions (moisture, nutrients, temperature) which are only achieved a few days each year in the field, if at all. The transfer of these results has been attempted using a simple multiplication factor which results in **mean residence times of millennia under field conditions**. The accuracy of this prediction is obviously very uncertain, thus, field studies are required. However, where extrapolation of lab studies is already a problem, extrapolation of field data is even more challenging due to daily and yearly variability. Additional factors which complicate field experiment are surface-runoff of biochar and leaching through the soil. Yet, unquestionably, **biomass is much more stable after pyrolysis compared to when fresh**; biomass degrades in weeks to months, while biochar is stable for at least decades to centuries. To summarise, we will never be able to accurately predict the stability of biochar in soil since its degradation is influenced by far too many factors and its life-span is too long to monitor in any experiment. We can only approximate likely biochar stability, and these approximations will get closer to reality when high-tech equipment like isotope-analysis is used. Still, the bigger question is how accurately must we be able to predict biochar longevity in the soil to be able to prove that it 'works'?



The BBF Newsletter is produced four times a year. We welcome content from members reporting on their biochar related activities. Please send content to Thomas White (thomas@britishbiocharfoundation.org) or Simon Shackley (simon@britishbiocharfoundation.org)

British Biochar Foundation Directory

"The BBF Directory is a FREE service provided by members to advertise biochar related products, services and biochar producing technologies"

The BBF Directory is a FREE service provided by the BBF to all members to advertise biochar products, services and biochar producing technologies. The free listing can be up to 5000 characters with up to four images and a hyperlink to a website. The listing comes with a contact form so other users and browsers can contact you regarding your listing. The content is entirely up to you but will be checked-over by BBF and changes might be requested prior to listing. Please note that hyperlinks and email addresses are not permitted in the listing itself and will be removed before publication

Users have to register to use the Directory separately from the Forum site. The Directory can also be used for advertising the availability of biochar or feedstock for producing biochar or for advertising a request to obtain feedstock or a particular type of biochar.

If you have any questions, please contact Simon Shackley on:

simon@ britishbiocharfoundation.org

To find the directory please visit:

www.britishbiocharfoundation.org/directory

With Thanks to:

Hannah Scott, University of Greenwich, Natural Resources Institute, PhD on biochar and soil water availability. Interests: Biochar internal pore size distribution, biochar production in the UK, sustainable farming systems and housing allocation on agricultural land in UK.

Jessica Shepherd, University of Edinburgh, School of GeoSciences, PhD on Nutrient recycling from bioresources. Interests: Phosphorus sustainability, nutrient recovery from wastewater treatment, intergenerational justice.

Wolfram Buss, UK Biochar Research Centre, University of Edinburgh, PhD on Contamination in Biochar. Interests: Environmental and agricultural sustainability and sustainable energy production.

Simon Shackley

Tom White

Any Questions please contact the BBF by email or phone at:

Email: info@britishbiocharfoundation.org

Phone: 07920066830

www.britishbiocharfoundation.org