



## Climate smart solution at stake: Biochar

► Biochar is promoted as a silver bullet for various challenges: enhancing carbon sequestration in soils, enriching soils in order to raise yields, and contributing to food security and poverty reduction. In order to spread this technology, many now advocate including biochar and soil carbon in general in a carbon market scheme. Against this background MISEREOR commissioned a study to Almuth Ernsting from Biofuelwatch titled 'Biochar – a climate smart solution?'. It highlights the lack of independent accounts or evaluations in relation to biochar projects in developing countries, which makes it difficult to make an assessment of the approach's climate change mitigation outcomes. Furthermore, evidence of the multiple benefits of biochar is scant to non-existent.

### Biochar – many promises

Biochar is fine-grained charcoal. Like all charcoal it is made of biomass such as wood, crops and plant residues. By means of a process called pyrolysis, the biomass is exposed to high temperatures under limited oxygen supply. In modern pyrolysis processes, energy produced from the combustion of biomass is captured in gaseous ('syngas') and/or liquid ('bio-oil') form, which can be used as fossil fuel. Biochar is applied to soils with the aim of sequestering carbon and reducing emissions of greenhouse gases such as N<sub>2</sub>O. This positive outcome could happen if biochar improves plant growth in such a way that the use of fertilisers decreases or if it affects soil microbes in such a way that they cause less nitrous oxide emissions and methane to be emitted. In that manner, biochar is hoped to make soils more fertile. The International Biochar Initiative (IBI) is the main international advocacy group for biochar support. IBI argues for its promotion and inclusion in carbon market schemes. Members of the initiative are companies, independent consultants and public sector research institutes, start-up biochar and pyrolysis companies, carbon offset firms and bioenergy companies.

### Few field trials

Generally, biochar practice is still in its infancy, as only small-scale field trials exist at present. Most projects are in Africa and to a lesser extent in Latin America or the Caribbean. The largest and best known ones are found in the DR Congo and in Cameroon, where they are conducted by IBI companies. A small number of NGOs is involved. Only a limited number of reliable field studies are under way, which are mostly short-term trials at that. Among them, most look at the use of fine-grained char-

### Terra Preta

► Highly fertile and carbon-rich soils in central Amazonia, called terra preta, are 500 to 1,500 years old. They are widely cited as evidence that biochar works. Not surprisingly, there are major differences between the properties of terra preta and those of soils with modern biochar. Nonetheless, references to terra preta are being used widely to promote biochar. While it is still unclear whether biochar can play a role in enhancing soil fertility and sequestering carbon as terra preta does, it is worrying that various patent applications and trademarks for biochar exist that even use the term 'terra preta'. The patenting of knowledge based on 'terra preta' and of other knowledge and practices which belong to existing and past indigenous and farming communities must be averted. ◀



*Biochar – the new black gold?*

coal in combination with synthetic fertilisers, with manure or both. Most involve crops grown in monocultures, usually with the aid of agro-chemicals.

### No mitigation potential

Biochar is promoted as enabling carbon neutral or even carbon negative agriculture. Clearly, the mitigation potential depends on which type of biochar is used, to what kind of soil it is applied

and in which combination of fertilisers. But the desk study commissioned by MISEREOR reveals, from the limited number of reliable field trials, that the technique either not increases soil carbon at all or does not increase it as much as would be attained by organic fertilisers like compost. Furthermore, biochar is claimed to reduce emissions from soils, for instance nitrous oxide (N<sub>2</sub>O). Unfortunately, only one field study looks at the effect of biochar upon nitrous oxide emissions and finds that a very large input of biochar is required to reduce these emissions.

### Minor effect on crop yields

According to its advocates biochar raises soil fertility and thus increases crop yields. Biochar may have positive long-term effects on soils – this is mainly due to a lesser degree of compaction and the soil's greater capacity to hold water, which in turn allows improved nutrient transfer. The experience of the limited trials so far shows that crop yields are highly variable and even lower yields are observed. Furthermore, a number of the positive effects have been shown to be short-lived and disappear after a few years.

### Huge amount of biomass needed

The production of biochar requires very large amounts of wood and/or other biomass. Producing 10 tonnes of biochar requires around 50 tonnes of biomass. This is much more than the residues that may be found on any hectare of land. It is important to keep in mind that most livelihoods rely on livestock and need part of the residues for animal fodder. A field study in central Amazonia, for example, reveals that to make one hectare of soil more fertile for four years an amount of wood equivalent to two hectares of secondary tropical forest is required. If farmers wanted to apply as much biochar to their land as is used in most field trials, then, unless they were to cut down forests, they would need to either set aside part of their land to grow crops and trees solely to make biochar – hardly an option for small farmers. If biochar is applied in large amounts to agro-industrially managed fields, biomass production for biochar may also lead to higher demand for land and may even provoke landgrabbing. Proponents of biochar claim that residues from urban areas or food production can be used for the production of biochar. Such production at an industrial scale may be promising for large farmers in the future but does not appear viable for small-scale farmers with low capital and limited access to markets.

### Recommendations

It is more than questionable whether biochar offers any potential to benefit the poor. Biochar appears to be a high-risk strategy for small farmers, rather than a reliable way to benefit them. First, there is no clear evidence of higher crop yields backed by science. Second, the very large amount of biomass required is not a realistic proposition for small farmers. Furthermore, from the data presented up to now, there is no clear evidence that carbon sequestration can be raised and emissions from soils can be reduced by biochar at all. In this situation, some 130 organisations worldwide already signed a declaration in 2008 urging caution over biochar and opposing the inclusion of soils in carbon markets. The

### The WorldStove company

➤ To overcome the barriers imposed by limited access to biomass, the WorldStove Company has developed a stove that uses biomass and converts it into biochar while providing energy for cooking in rural households. According to that company, one family using such a designated biochar stove three times a day would produce 438 kg biochar per year. Under this assumption, one family would need to use it for nearly 23 years to produce 10 tonnes of biochar – the common minimum used per hectare by many recent trials, e.g. in central Amazonia or western Kenya. It would require a significant initial investment and ongoing cost and this would be especially unattractive if users cannot be sure about the positive effects of biochar application. ◀



declaration states: 'Small-scale agro-ecological farming and protection of natural ecosystems are effective ways to reduce emissions from agriculture and to mitigate the impacts of climate change. These proven alternatives should be fully supported' (Rainforest Rescue 2008: [www.rainforest-rescue.org/news/1150/declaration-biochar-a-newbig-threat-to-people-land-and-ecosystems](http://www.rainforest-rescue.org/news/1150/declaration-biochar-a-newbig-threat-to-people-land-and-ecosystems)). ◀

The full report **'Biochar – a climate smart solution?'** is available under: [http://www.misereor.de/fileadmin/redaktion/Report1\\_Biochar\\_111122.pdf](http://www.misereor.de/fileadmin/redaktion/Report1_Biochar_111122.pdf)

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Bischöfliches Hilfswerk MISEREOR e.V.  
Mozartstraße 9, 52064 Aachen, Germany  
Tel.: +49 (0)241 442 0, Fax: +49 (0)241 442 188  
[www.misereor.de](http://www.misereor.de), [www.misereor.org](http://www.misereor.org)

Contact: Anika Schroeder, [anika.schroeder@misereor.de](mailto:anika.schroeder@misereor.de)

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