

Biochar: black revolution for agriculture and the environment?

by Anita Maienza

On 17 and 18 January 2013 the meeting entitled "1st Mediterranean Symposium on Biochar" was held at the offices of the Minoprio Foundation in Vertemate con Minoprio (Como, Italy). Biochar, or charcoal, is the residue that is obtained from the production of energy from plant biomass. The history of biochar is long; it was a practice of the Amazon populations to use waste products of thermochemical processes applied on waste plant material as a soil conditioner in order to improve the fertility of the soil. The effect of biochar on cultures to increase yields, is known for a long time and in The United States of America its production and trade as soil amendment is already a real business (Fig. 1).



Fig.1 Commercial Biochar in USA.

In recent years, biochar has excited the scientific community studying climate change for its effect of carbon sequestration (i.e the ability to absorb carbon and sequester CO₂ in the soil (Fig. 2).

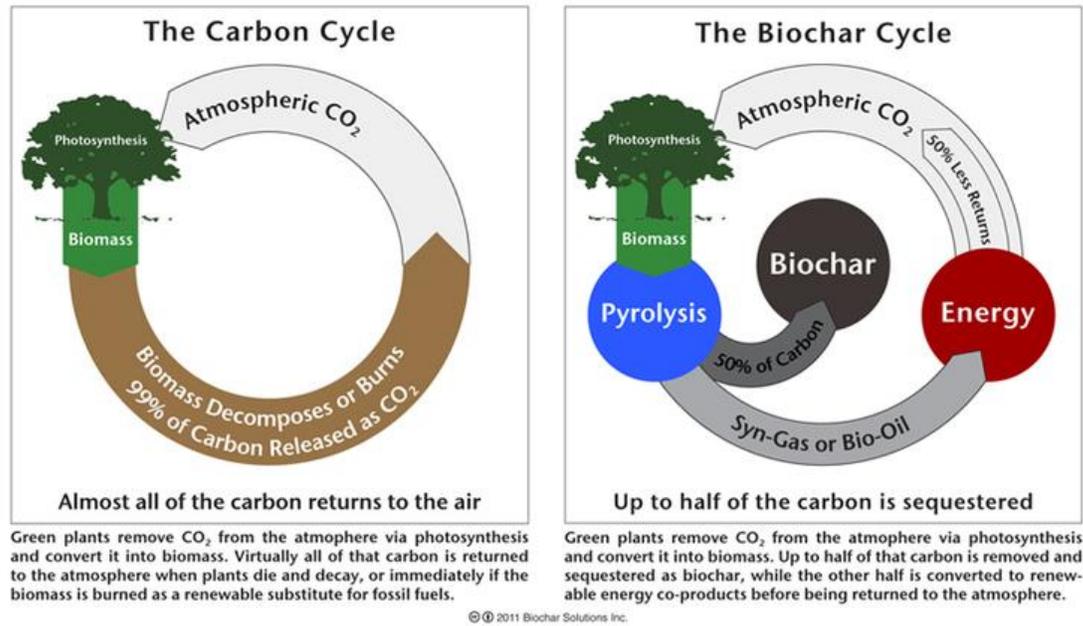


Fig.2 Biochar and carbon sequestration.

At the meeting some of the international leading experts in the field as Johannes Lehmann (Cornell University), Bruno Glaser (University of Halle), Saran Sohi (University of Edinburgh) and Franco Miglietta (CNR-Ibimet, Florence) highlighted the latest studies, the research and experimentation related to biochar.

As a totally new material, biochar is available for studies of broad-spectrum and is attracting interest of experts in different areas of study. Proven the biochar positive characteristics for agriculture (yield, increased soil fertility, decontaminating effect, water retention) research is now focusing on the reasons behind these effects, the possible applications and on responding to the open questions about possible environmental damages.

Some questions are still unanswered, no experiments exist showing the environmental long term effects and there is a lack of data on polycyclic aromatic hydrocarbons (PAHs) that biochar could generate along the production process, polluting the culture and the environment.

Moreover it is necessary to focus the attention on traceability of feedstock (where, how, when) and production temperature, since these factors affect both the nutrient content of biochar and its agricultural and environmental characteristics.

During the Symposium Dr. Miglietta illustrated the ongoing studies on historical charcoal pit (150 years ago) as important material for studying the long term effect of biochar incorporation in the soil.

The speakers also stressed the need to take a certification of quality supported by the European legislation in order to stimulate the development of a market.

In his speech, Prof. Glaser underlined the necessary steps to achieve the European certification: 1) documentation on the manufacturing processes and basic chemical and physical properties to identify the biochar as a soil amendment; 2) guidelines to follow for the transportation and on-field application; 3) traceability of biomasses; 4) biological and eco-toxicological analysis for a safe use in agriculture.

The Symposium was also attended by companies producing biochar; these companies operate to convert plant biomass into a source of energy (and therefore income) and produce a charcoal co-product through the processes of gasification and hydrogasification.

Gasification is a process of thermal degradation in which a plant biomass (or other organic matrices) is partially oxidized by heating at high temperatures (above 1000° C) in gas and biochar. The gas (syngas) is a mixture of carbon monoxide and carbon dioxide, methane and nitrogen which is used to drive an endothermic cycle to produce electricity and heat ready for direct use. One of the major gasification companies in Italy is [AGT \(Advanced Gasification Technology\)](#). Open Fields is a partner of AGT on the valorization of biochar for the utilization in agriculture.

Hydrothermal carbonization (HTC) is an alternative process to gasification driven in the presence of water at temperatures around 200° C and under high pressure, obtaining as co-product liquid biochar which is subsequently dried. One of the leading European companies working in industrial HTC is the German CS Carbon Solution.

The two companies mentioned above are partners of [EUROCHAR](#) an European project coordinated by Dr. Franco Miglietta that aims to study the effect of 1. biochar obtained at different temperatures; 2. biochar distributed on soils with different cultures and 3. biochar employed in diverse climatic areas. Franco Miglietta is also president of the Italian Biochar Association ([ICHAR](#)) which is committed to promoting the use of biochar in our country through actions and scientific experiments of international interest.

Other projects have studied the design of pyrolysis stoves for domestic use (which allow for the production of heat for cooking or heating) associated with the production of biochar to be used as crop amendment (Fig. 3). During the symposium Prof. Peressotti of the University of Udine showed the strategies and opportunities of adopting pyrolytic stoves in African Countries to cook food and produce biochar.

In Italy the use of biochar is still not regulated and ICHAR submitted a proposal, to the Scientific Commission on Fertilizers of the Italian Ministry of Agricultural, Food and Forestry Policies (MiPAAF), to include biochar as soil amendment. The proposal is currently under evaluation. The potentialities of biochar are many, and Open Fields, as careful observer of the new frontiers in the environmental and agronomic areas, has decided to invest in projects on biochar taking an active part in the experimentation.



Fig. 3 Example of pyrolysis stove for domestic use.



Fig.4 Group picture of the 1st International Symposium on Biochar.