



July 2012

IBI Announces Biochar Sustainability Guidelines Process and Timeline

In order to fulfill its mission (<http://www.biochar-international.org/about>), IBI has committed to creating *Biochar Sustainability Guidelines* for biochar producers, markets, and regulators to assist in monitoring and evaluating the sustainability of existing or proposed biochar systems.

The IBI process for creating *Biochar Sustainability Guidelines* is international in scope and will involve the public and stakeholders throughout by using surveys, webinar presentations and posting documents online for comment. It will draw upon a large body of sustainability assessments and evaluations from related areas such as climate, bioenergy, forestry and agriculture. The process was started in June when IBI staff circulated a draft of Principles to Guide Sustainability Guidelines Development to the IBI Advisory Committee for review, and it is projected for completion by the end of March 2013.

The IBI *Biochar Sustainability Guidelines* are intended to be a practical tool for sustainability evaluation that will have utility for different regions, feedstocks, technologies, environments and communities. Because all of these contexts are so variable, and the biochar industry is so new, the initial *Biochar Sustainability Guidelines* will provide self-reporting checklists that identify good, better and best practices, rather than absolute standards that require testing and certification.

IBI will produce four interim documents that will be merged at the end of the process to comprise the final *Biochar Sustainability Guidelines*. Proceeding in this stepwise fashion will provide a fully transparent view of IBI's process and allow for timely input from experts and stakeholders. The four interim documents are: 1) *Biochar Sustainability Principles*; 2) *Biochar System Case Studies*; 3) *Biochar System Typology with Sustainability Checklists*; and 4) *Compendium of Preferred Sustainability Assessment Methodologies and Resources*.

A draft of the first document, *Biochar Sustainability Principles*, is now available for review online (<http://www.biochar-international.org/sustainability>). IBI will schedule webinars in September to answer questions about the *Principles*, and welcomes your comments and suggestions at any time. Comments may be sent to: SustainableBiochar@gmail.com.

Biochar Protocol for Carbon Market - Biochar Carbon Stability Test

One of the most relevant characteristics of biochar is its long-term stability in soil, which is determinant for its potential as a strategy for climate change mitigation, among other benefits. That is why, at this phase of the development of a Biochar Greenhouse Gas Protocol, IBI is leading an effort to identify a test methodology to assess and quantify the stability of carbon contained in biochar when applied to soil. This effort, called Biochar Carbon Stability Test, has the objective of developing a methodology for testing the permanence of carbon sequestration in biochar with at least 100-year residence time in soil (with 100 years being the pro forma definition

of permanence in the Kyoto Protocol, therefore applied to all carbon exchange mechanisms under its mandate).

IBI is undertaking this effort in the same participative and transparent fashion that was utilized to develop the *IBI Biochar Standards*. Therefore a group of experts with relevant experience was invited and convened during the month of June. Additional experts joined the Expert Panel via the public call for nominations that was launched in the previous IBI Newsletter. Of the final 15 members of the Expert Panel, most possess a scientific background and relative experience, while some represent the commercial sector, providing balance to the group to ensure that the final product is acceptable to end-users. IBI is satisfied that the quantity and mix of experts on the panel will aid in the development of a credible, solid product.

IBI staff facilitating the Expert Panel developed a list of relevant peer-reviewed publications and methodologies for determining biochar carbon stability in soil, with the valuable collaboration of the experts, who in many cases are authors or co-authors of the publications, and were kind enough to share their work. The list was shared with the Expert Panel as background material prior to the first Panel meeting.

The Panel's first meeting was held on July 12 (for Panel members in the American and European continents) and July 13 (for members in Australia and New Zealand). The critical outcome of the first meeting was the definition of the scope of a biochar C stability test, which was achieved by consensus.

The measurement of certain physico-chemical properties of biochar was deemed sufficient to determine biochar C stability in soil for at least 100 years. It was also decided that a conservative approach be taken for defining the test methodology. Finally, it was generally agreed that a methodology that would not require (intense) monitoring would be desirable.

The next milestone to be reached is a revised seed document, built upon the guidance of the Expert Panel and on existing test methodologies. The second meeting of the Panel will focus discussion around the revised seed document.

IBI wishes to thank the members of the Expert Panel, who voluntarily agreed to devote their time to this collective effort, for which we express our gratitude in the name of the global biochar community. The Members of the Expert Panel include:

- David Andersson, EcoEra, Sweden
- Alice Budai, Norwegian Institute for Agricultural and Environmental Research – Bioforsk, Norway
- Marta Camps, Institute of Natural Resources, Massey University, New Zealand
- Annette Cowie, Rural Climate Solutions, University of New England, NSW Department of Primary Industries, Australia
- Bruno Glaser, Soil Physics Group, University of Bayreuth, Germany
- Stephen Joseph, School of Materials Science and Engineering, University of New South Wales, Australia
- Johannes Lehmann, Department of Crop and Soil Sciences, Cornell University, United States
- Caroline Masiello, Department of Earth Science, Rice University, United States
- Paul Munroe, School of Materials Science and Engineering, University of New South Wales, Australia
- Frank Shields, Control Laboratories, Inc., United States
- Bhupinderpal Singh, NSW Department of Primary Industries, Australia
- Saran Sohi, UK Biochar Research Centre, United Kingdom
- Beau Webber, School of Physical Sciences, University of Kent, United Kingdom
- Morgan Williams, Biochar Solutions, United States

- Andrew Zimmerman, Dept. of Geological Science, University of Florida, United States

IBI Biochar Certification Program Update

IBI held informational webinars on the IBI Biochar Certification Program on July 9th and July 12th. We appreciate the great turnout at both sessions and the questions raised by participants. A copy of the presentation is available at: (http://www.biochar-international.org/sites/default/files/IBI_Certification_Program_Presentation.pdf).

IBI is now developing the IBI Biochar Certification Program web pages, which will house all program materials needed to certify biochar through IBI's online process. Prior to launching the program later this summer, the program and materials will undergo further legal review and user testing. Future webinars will be held to review the final program materials and the certification process.

For questions or further inquiries regarding the IBI Biochar Certification Program, please contact us at certification@biochar-international.org

New IBI Business Members:

A listing of all current IBI Business Members can be found on our website at: <http://www.biochar-international.org/IBI-business-members>. For more information on a membership or to join, please see: <http://www.biochar-international.org/join>.

Bison Soil Solutions

Bison Soil Solutions is proud to offer a line of all natural, organic products designed to improve soils in an ecological and sustainable manner with a strong commitment to the family owned business model. The Bison Soil Solutions line of organic bison manure compost products represent the culmination of over a decade of research and actual field trials. After extensive testing of massive windrows with composted Bison Manure, some over 10 years of age, they have discovered that as the manure ages and matures the biological complexity and diversity continues to intensify, establishing amazing populations of active food web microbes. For more information, please see: <http://www.bisonsoil.com> or contact slimbuttes@sdplains.com Jacki Limpert



VenEarth Group LLC

VenEarth Group LLC develops and invests in sustainable agricultural and energy technologies.



VENEARTH GROUP LLC

VenEarth and its portfolio companies have assembled an international team of scientists, engineers and business leaders to develop earth-friendly technologies and businesses. They are focused on two complementary strategies: First, to drive down the cost of collecting surplus solar energy over farmland (particularly in areas subject to desertification). Second, to enhance carbon sequestration in soil biosystems by driving down the cost of converting excess agricultural biomass into carbon-rich soil amendments. Their goal is to transform the net impact of farming (especially in third-world nations) to withdraw tons per hectare of CO₂ from the atmosphere each year, while enhancing the energy, economy and health of farming communities. For more information, please see: www.venearth.com or contact info@venearth.com.

Biochar Production Technology in China Discussed at a Recent Panel Organized by the Chinese Government

On July 6 2012, members of the Chinese Ministry of Education visited Nanjing Agricultural University and assessed the University's biochar production technology for utilizing crop wastes (mainly straw). The technology was developed by the Center of Biochar and Green Agriculture in joint cooperation with Sanli New Energy Co Ltd, Shangqiu, China. Professor Genxing Pan, the project leader, gave a very detailed report on the production unit and the resulting biochar, highlighting eight field experiments from across mainland China, all of which showed positive responses to biochar application. The panel participants discussed routes to expand opportunities for the country's rural agricultural sector—to reduce costs and the carbon intensity from farming. For more information, please see: http://www.biochar-international.org/sites/default/files/News_of_biochar_technology_of_China_July_2012.pdf

New Research Initiative: An International Leverhulme Trust Network

Biochar: an effective carbon capture method is a new United Kingdom-Canadian Network that will investigate the potential of biochar as a technically and economically effective method of capturing carbon in a stabilized form while simultaneously increasing soil quality and thus adaptability of agriculture to climate change. Some of the Network's key objectives include:

- i. Exchange methodologies on thermal cracking for biochar production with the aim to develop and promote best practice guidelines.
- ii. Develop modeling methodologies to complement and expand on the experimental expertise in the UK and Canada.
- iii. Train a young generation of researchers in the area.
- iv. Create the critical mass to position the UK and Canada as the leaders in the area of biochar production, utilization and standardization.
- v. Create a dedicated website.
- vi. Increase the awareness of the public and policy makers about biochar as a sustainable option for climate change mitigation and adaptation by publicizing important outcomes of the network activities (website, social media, open days with media presence etc.).

The Network comprises two UK and four Canadian partners: Heriot-Watt University (UK), University of Edinburgh (UK), Western University (Canada), University of Saskatchewan (Canada), and McGill University (Canada). For more information on this network, please see: <http://www.biochar-international.org/node/3480>.

Biochar Briefs: News Roundup for July

We update the website daily with new articles on biochar. For more information, please see: <http://www.biochar-international.org/newsbriefs>.

Australia

<http://www.sciencewa.net.au/topics/agriculture/item/1552-biochar-efficacy-on-soil-nitrogen-questioned>

A University of Western Australia study has challenged claims that biochar is more effective in minimizing nitrogen leaching from soil than traditional clay amendments. The study found that biochar does not possess significantly better nutrient absorption qualities than clay, although both are acknowledged as beneficial in reducing nitrogen leaching.

Brazil

http://acritica.uol.com.br/amazonia/Amazonas-Amazonia-Manaus-internacionais-Terra-Preta-Indio_0_733726673.html

Recent symposia on the past, present, and future of Anthropogenic Dark Earths were held in Manaus under the joint sponsorship of Wageningen University (Netherlands), the Brazilian Agricultural Research Corporation (Embrapa), and the National Institute for Amazonian Research (INPA). Separate workshops on the Terra Preta Program focused on how to improve the livelihoods of farmers living in the Amazon through sustainable use and conservation of Terra Preta soils and the creation of new Terra Preta. This program includes the participation of several research institutions in Brazil, Colombia, and Bolivia.

Canada

<http://www.meadowlakeprogress.com/ArticleDisplay.aspx?e=3595001>

Soil scientists at the University of Saskatchewan have received an Idea of Innovation grant worth \$660,600 from the Natural Sciences and Engineering Research Council of Canada to research high phosphorus bone biochar for use in remediating oil and gas spill sites.

Costa Rica

<http://www.sfgate.com/opinion/openforum/article/Governments-can-help-companies-work-with-nature-3653904.php>

Jon B. Rogers, co-founder and president of the Rogers Family Co., is using biochar on his family's coffee farm in Costa Rica. He believes that governments can help companies that use carbon negative technologies and has a list of recommendations.

Germany

[http://www.mz-](http://www.mz-web.de/servlet/ContentServer?pagename=ksta/page&atype=ksArtikel&aid=1338485309838&openMenu=1013083806226&calledPageId=1013083806226&listid=1018881578460)

[web.de/servlet/ContentServer?pagename=ksta/page&atype=ksArtikel&aid=1338485309838&openMenu=1013083806226&calledPageId=1013083806226&listid=1018881578460](http://www.mz-web.de/servlet/ContentServer?pagename=ksta/page&atype=ksArtikel&aid=1338485309838&openMenu=1013083806226&calledPageId=1013083806226&listid=1018881578460)

During Halle's "Long Night of Science," an annual science education fair with 300 events in 24 hours, children and adults found that the offerings at the Institute of Agricultural and Food Sciences were all about biochar, including showings of the film, "Biochar - a way out of climate and food crisis?"

Indonesia

http://blog.cifor.org/8929/charred-lands-fertile-grounds-for-sustainable-agriculture-in-kalimantan/#.T_8B8nAh1PA

A multidisciplinary research team has found evidence that the "Black Soil" of Indonesia's Kalimantan province, like its Amazon analogue, is "anthropogenic"—a product of decades, if not centuries, of human cultivation.

Sri Lanka

http://www.island.lk/index.php?page_cat=article-details&page=article-details&code_title=56301

Biochar research and practice are taking off in Sri Lanka where it has the potential to solve several crucial problems with energy and agriculture, according to Dr. R. S. Dharmakeerthi, a Senior Soil Scientist attached to the Rubber Research Institute of Sri Lanka.

http://www.sundaytimes.lk/index.php?option=com_content&view=article&id=20884:biochar-can-it-put-the-tea-industry-back-in-the-black-&catid=79:analysis&Itemid=565

Can biochar put the tea industry back in the black? J.C. Krishnaratne, Director of R&D at the Biochar Initiative Co in Sri Lanka, examines ideas for biochar systems that could help revitalize the tea industry.

United Kingdom

<http://www.rotherhamadvertiser.co.uk/news/92217/wingfield-college-students-pioneering-greener-forest.aspx>

Fulbright researchers are partnering with younger students and the city of Rotherham to plant trees in biochar enhanced soil and monitor their growth as a climate mitigation strategy.

<http://www.bdonline.co.uk/student/class-of/class-of-2012-luke-snow-de-montfort-university/5039827.article>

Towards a Carbon-Negative Britain is a student design project involving biomass waste, biochar, energy, and greenhouse grown crops. Competition judges called it “An inspiring interaction between recycling and architectural processes”.

<http://www.fifetoday.co.uk/community/community-news/falkland-professor-presented-with-obe-1-2420221>

Professor Stuart Haszeldine was presented with the Order of the British Empire (OBE) award by the Queen of England for his services to climate change technologies including biochar. Haszeldine said that the award is on behalf of a large team at the University of Edinburgh working on these problems.

United States

<http://domesticfuel.com/2012/07/11/adding-value-to-ethanol-byproducts/>

USDA's Kurt Spokas has been working with the Minnesota Corn Growers on using microwave pyrolysis to convert distillers grains into bio-oil and biochar. Spokas told the recent Corn Utilization Technology Conference that he hopes to have field plots soon to see what larger scale impacts could be.

<http://www.futurity.org/earth-environment/oil-spill-intensified-erosion-in-gulf-marshes/>

Researchers at the University of Florida are testing the effectiveness of biochar for removing toxic PAH (polyaromatic hydrocarbons) from shorelines hit by the 2010 Deepwater Horizon oil spill in the Gulf of Mexico.

US Biochar Conference Only 4 Days Away; Offers Introductory Session Biochar 101:

Rohnert Park, California – The US Biochar Conference, to be held July 29 – August 1 at Sonoma State University, in Rohnert Park, California, has announced it will offer a session on the basics of biochar and the industry that is growing up around it. Called “Biochar 101,” the session will include a concise presentation on the basics of biochar—what it is, what it does, and the current developing exploration, research, and debate over its promise and future.



For researchers, advocates and policy makers who are just being introduced to the topic, presenters Peter Hirst and Alex Dolginow will cover the most important characteristics of biochar and of the industry growing around it. Hirst, consultant and co-founder of New England Biochar, will give an overview of biochar, emphasizing its most important characteristics and their implications. Dolginow, Harvard fellow and implementation manager for agriculture, forestry, open space and adaptation for the Climate Protection Campaign, will expand on these themes using actual examples and actions from Sonoma County.

While conference attendees are spending three days exploring these topics in depth, this session is designed for those who want to get to the heart of biochar in a single afternoon session. Time will be allotted for discussion and questions.

Biochar 101 will be offered on Tuesday, July 31, 2012, from 1:30 to 2:30 p.m. at the conference location at Sonoma State University. To register for the session or for the complete conference, visit <http://2012.biochar.us.com/registration>.

Opportunities in Biochar

- Submit an Abstract: 2012 AGU session on the "Potential Capacities to Sequester Carbon at a Regional Scale" (B050). The goal of this session is to bring together biologists, geologists, engineers and others to discuss available carbon storage options at the local and regional scales. AGU abstracts for oral presentations and posters are due by August 8. Additional session information is available at: <http://fallmeeting.agu.org/2012/session-search/single/potential-capacities-to-sequester-carbon-at-a-regional-scale/>
- Registration now open: The 2nd Nordic Biochar Seminar (February 14 – 15, 2013 in Helsinki, Finland); see: <http://www.nif.nu/site/seminarRedirect.asp?intSeminarID=459&p=1004>.

Upcoming Calendar Events

- July 28 – 29: 2 Day Biochar Intensive course at Lifebridge Sanctuary; location Rosendale, NY, USA; more information: <http://www.biochar-international.org/node/3450>.
- July 29 – August 1: United States Biochar Conference; location Sonoma, CA, United States; more information and registration: <http://2012.biochar.us.com>.
- August 5 – 10: CHAB 3rd Annual Camp (Combined Heat and Biochar); location Belchertown, MA, United States; more information at: http://www.biochar-international.org/CHAB_III_Camp.
- August 28 – 30: Farm Progress Show 2012 at Central Iowa Expo; location Boone, IA, United States; more information: www.tradeshows.net/trade-event-detail/farm-progress-show.html.
- August 31 – September 4: CHAB Camp (Combined Heat and Biochar); location Summertown, TN, United States; more information: <http://www.biochar-international.org/node/3224>.
- September 9 – 16: 1st International Summer School on Biochar; location Potsdam, Germany; more information: <http://www.biochar-international.org/node/3179>.
- September 10 – 15: International Training Course on Biochar Production, Testing and Utilisation; location Nanjing, China; more information: <http://www.biochar-international.org/node/3239>.
- September 16 – 20: 4th International Biochar Congress; Biochar: The Road to Richer Food and a Safer Environment; location Beijing, China; more information: <http://www.ibi2012.org>.
- September 19: Talk on Biochar to Master Gardeners; location Volusia County, FL, US; more information: <http://www.biochar-international.org/node/3390>.
- October 10 – 11: Biogas USA West; location San Francisco, CA, USA; more information: <http://www.biochar-international.org/node/3301>.
- October 17 – 19: RETECH 2012; location: Washington DC, USA; more information: <http://www.biochar-international.org/node/3083>.

See the [IBI Calendar page](#) for more events. To add an event to the calendar, send the information to info@biochar-international.org.

Regional Biochar Group Updates

To read more on the 44 regional and national biochar groups, please see IBI's website. This month includes an update from the Rocky Mountain Biochar Initiative from the United States.

The Rocky Mountain Biochar Initiative (RMBI)

The Rocky Mountain Biochar Initiative was one of the earliest regional biochar groups to form. RMBI members helped organize and are active on the Board of the US Biochar Initiative (USBI). RMBI members organized the North American Biochar Conference 2009 (<http://www.regonline.com/builder/site/Default.aspx?eventid=684390>), held in Boulder Colorado August 9th-12, 2009.

Meetings are held approximately every three to six months at the member institutions who are all active in Biochar research programs: Colorado School of Mines (CSM, Golden), Colorado State University (CSU, Ft. Collins), University of Colorado in Boulder (CU-B, Boulder), and the National Renewable Energy Laboratory (NREL, Golden). The Google mailing list currently goes to about 75 individuals, mostly near Denver, but including numerous members from other parts of Colorado. We are also ready to help Biochar-interested persons in nearby states.

For more information, please see: <http://www.biochar-international.org/regional/colorado>.

Recently Published Biochar Research

IBI tracks all published research on biochar and includes it in our [online bibliography](#). The following articles were added in the last month. Please visit the website bibliography for more information on any of these articles. Due to copyright, we cannot provide full copies of articles unless we have permission from the publisher. If you have published work that is not included, [please email us](#).

Abit, Sergio M; Carl Bolster; Peng Cai; and Sharon Louise Walker (2012). Influence of feedstock and pyrolysis temperature of biochar amendments on transport of Escherichia coli in saturated and unsaturated soil. Environ. Sci. Technol.

Alho, Carlos Francisco Brazão Vieira; Abmael da Silva Cardoso; Bruno José Rodrigues Alves; and Etelvino Henrique Novotny (2012). Biochar and soil nitrous oxide emissions. Pesquisa Agropecuária Brasileira. <https://seer.sct.embrapa.br/index.php/pab/article/viewFile/10030/6921>

Arif, M., A. Ali, M. Umair, F. Munsif, K. Ali, Inamullah, M. Saleem and G. Ayub. (2012). Effect of biochar FYM and mineral nitrogen alone and in combination on yield and yield components of maize. Sarhad J. Agric. 28(2):191-195; http://www.aup.edu.pk/sj_pdf/EFFECT%20OF%20BIOCHAR,%20FYM%20AND%20MINERAL%20NITROGEN%20-35-2012.pdf.

Augustenborg, Cara A.; Simone Hepp; Claudia Kammann; David Hagan; Olaf Schmidt; and Christoph Müller (2012). Biochar and Earthworm Effects on Soil Nitrous Oxide and Carbon Dioxide Emissions. Journal of Environmental Quality. Vol. 41 No. 4, p. 1203-1209.

Brewer, Catherine E.; Yan-Yan Hu; Klaus Schmidt-Rohr; Thomas E. Loynachan; David A. Laird; and Robert C. Brown (2012). Extent of Pyrolysis Impacts on Fast Pyrolysis Biochar Properties. *Journal of Environmental Quality*. Vol. 41 No. 4, p. 1115-1122.

Bruun, Esben W.; Carsten Petersen; Bjarne W. Strobel; and Henrik Hauggaard-Nielsen (2012). Nitrogen and Carbon Leaching in Repacked Sandy Soil with Added Fine Particulate Biochar. *Soil Science Society of America Journal*. Vol. 76 No. 4, p. 1142-1148

Bruun, Sander; Tarek El-Zehery (2012). Biochar effect on the mineralization of soil organic matter. *Pesquisa Agropecuária Brasileira*. vol. 47 no. 5.

Buss, Wolfram; Claudia Kammann; and Hans-Werner Koyro (2012). Biochar Reduces Copper Toxicity in *Chenopodium quinoa* Willd. in a Sandy Soil. *Journal of Environmental Quality*. Vol. 41 No. 4, p. 1157-1165.

Chaiwong, Kanyaporn; Tanongkiat Kiatsiriroat; Nat Vorayos and Churat Thararax (2012). Biochar production from freshwater algae by slow pyrolysis. *Maejo Int. J. Sci. Technol.* 6(02), 186-195; <http://www.mijst.mju.ac.th/vol6/186-195.pdf>.

Chee H. Chia, Bin Gong, Stephen D. Joseph, Christopher E. Marjo , Paul Munroe, Anne M. Rich (2012). Imaging of Mineral-Enriched Biochar by FTIR, Raman and SEM-EDX. *Vibrational Spectroscopy*.

Chen, Baoliang; Miaoxin Yuan; and Linbo Qian (2012). Enhanced bioremediation of PAH-contaminated soil by immobilized bacteria with plant residue and biochar as carriers. *Journal of Soils and Sediments*.

G. K. Choppala, N.S. Bolan, M. Megharaj, Z. Chen and R. Naidu (2012). The Influence of Biochar and Black Carbon on Reduction and Bioavailability of Chromate in Soils. *Journal of Environmental Quality*. Vol. 41 No. 4, p. 1175-1184.

Cowie, Annette L.; Adriana E. Downie; Brendan H. George; Bhupinder-Pal Singh; Lukas Van Zwieteren; and Deborah O'Connell (2012). Is sustainability certification for biochar the answer to environmental risks? *Pesquisa Agropecuária Brasileira*. Volume 47, n.5. http://www.scielo.br/scielo.php?pid=S0100-204X2012000500002&script=sci_arttext.

Dehkhoda, Amir Mehdi and Naoko Ellis (2012). Biochar-based catalyst for simultaneous reactions of esterification and transesterification. *Catalysis Today*.

Germano, Mariana Gomes; Fabiana de Souza Cannavan; Lucas William Mendes; Amanda Barbosa Lima; Wenceslau Geraldes Teixeira; Vivian Helena Pellizari; and Siu Mui Tsai (2012). Functional diversity of bacterial genes associated with aromatic hydrocarbon degradation in anthropogenic dark earth of Amazonia. *Pesquisa Agropecuária Brasileira*. Volume 47, n.5, p. 654-664.

J. A. Ippolito, J. M. Novak, W. J. Busscher, M. Ahmedna, D. Rehrh and D. W. Watts (2012). Switchgrass Biochar Affects Two Aridisols. *Journal of Environmental Quality*. Vol. 41 No. 4, p. 1123-1130.

J. A. Ippolito, D. G. Strawn, K. G. Scheckel, J. M. Novak, M. Ahmedna and M. A. S. Niandou (2012). Macroscopic and Molecular Investigations of Copper Sorption by a Steam-Activated Biochar. *Journal of Environmental Quality*. Vol. 41 No. 4, p. 1150-1156.

Junxiang Jia, Bo Li, Zhaozhi Chen, Zubin Xie & Zhengqin Xiong (2012). Effects of biochar application on vegetable production and emissions of N₂O and CH₄. *Soil Science and Plant Nutrition*.

Kaal, Joeri; Maximilian P.W. Schneider; Michael W.I. Schmidt (2012). Rapid molecular screening of black carbon (biochar) thermosequences obtained from chestnut wood and rice straw: A pyrolysis-GC/MS study. *Biomass and Bioenergy*.

Kammann, Claudia; Stefan Ratering; Christian Eckhard; and Christoph Müller (2012). Biochar and Hydrochar Effects on Greenhouse Gas (Carbon Dioxide, Nitrous Oxide, and Methane) Fluxes from Soils. *Journal of Environmental Quality*. Vol. 41 No. 4, p. 1052-1066.

Koehler, Steffen D., Gerhardt Ed, and Joseph Stephen (2012). Improving Yields of Strawberries Grown in South Florida Through Addition of Compost Biochar and Minerals.

Lin, Yun; Paul Munroe; Stephen Joseph; Rita Henderson (2012). Migration of dissolved organic carbon in biochars and biochar-mineral complexes. *Pesquisa Agropecuária Brasileira*. *Pesquisa Agropecuária Brasileira*. Volume 47, n.5.

Ma Li; Hou ZhenAn; Lv Ning; Ye Jun; Su SiBo; Liang YinQiang (2012). Effects of biochar application on wheat growth and nitrogen balance. *Xinjiang Agricultural Sciences* 2012 Vol. 49 No. 4 pp. 589-594. <http://www.xjnykx.periodicals.com.cn>.

Major, Julie; Marco Rondon; Diego Molina; Susan J. Rih; and Johannes Lehmann (2012). Nutrient Leaching in a Colombian Savanna Oxisol Amended with Biochar. *Journal of Environmental Quality*. Vol. 41 No. 4, p. 1076-1086.

Joan Josep Manyà (2012). Pyrolysis for biochar purposes: a review to establish current knowledge gaps and research needs. *Environ. Sci. Technol.*

A. Méndez, A. Gómez, J. Paz-Ferreiro, G. Gascó (2012). Effects of sewage sludge biochar on plant metal availability after application to a Mediterranean soil. *Chemosphere*.

Novotny, Etelvino Henrique; Ruben Aucasse; Marcia Helena Rodrigues Velloso; Juliano Corulli Corrêa; Martha Mayumi Higarashi; Valéria Maria Nascimento Abreu; José Dilcio Rocha; and Witold Kwapinski (2012). Characterization of phosphate structures in biochar from swine bones. *Pesquisa Agropecuária Brasileira*. v.47, n.5, p. 672-676. <https://seer.sct.embrapa.br/index.php/pab/article/viewFile/10029/6914>.

Pereira, Rogério Gomes; Alexandre Bryan Heinemann; Beata Eموke Madari; Marcia Thais de Melo Carvalho; Huberto José Kliemann; and Aurélio Pereira dos Santos(2012). Transpiration response of upland rice to water deficit changed by different levels of eucalyptus biochar. *Pesquisa Agropecuária Brasileira*. v.47, n.5, p. 716-721. http://www.scielo.br/scielo.php?pid=S0100-204X2012000500012&script=sci_arttext.

Petter, Fabiano André; Beáta Emöke Madari; Mellissa Ananias Soler da Silva; Marco Aurélio Carbone Carneiro; Márcia Thais de Melo Carvalho; Ben Hur Marimon Júnior; and Leandro Pereira Pacheco (2012). Soil fertility and upland rice yield after biochar application in the Cerrado. *Pesquisa Agropecuária Brasileira*. v.47, n.5, p. 699-706. http://www.scielo.br/scielo.php?pid=S0100-204X2012000500010&script=sci_arttext&lng=pt.

Quilliam, Richard S.; Karina A. Marsden; Christoph Gertler; Johannes Rousk; Thomas H. DeLuca; Davey L. Jones (2012). Nutrient dynamics, microbial growth and weed emergence in biochar amended soil are influenced by time since application and reapplication rate. *Agriculture, Ecosystems & Environment*. Volume 158, Pages 192–199.

N. Rogovska; D. Laird; R. M. Cruse; S. Trabue; and E. Heaton (2012). Germination Tests for Assessing Biochar Quality. *Journal of Environmental Quality*. Vol. 41 No. 4, p. 1014-1022.

Schomberg, Harry H.; Julia W. Gaskin; Keith Harris; K.C. Das; Jeff M. Novak; Warren J. Busscher; Don W. Watts; Robin H. Woodroof; Isabel M. Lima; Mohamed Ahmedna; Djaafar Rehrh; and Baoshan Xing (2012). Influence of Biochar on Nitrogen Fractions in a Coastal Plain Soil. *Journal of Environmental Quality*. Vol. 41 No. 4, p. 1087-1095.

Shang, Guofeng; Guoqing Shen; Tingting Wang; Qin Chen (2012). Effectiveness and mechanisms of hydrogen sulfide adsorption by camphor-derived biochar. *Journal of the Air & Waste Management Association*. Volume 62, Issue 8, pages 873-879.

Spokas, Kurt A.; Keri B. Cantrell; Jeffrey M. Novak; David W. Archer; James A. Ippolito; Harold P. Collins; Akwasi A. Boateng; Isabel M. Lima; Marshall C. Lamb; Andrew J. McAloon; Rodrick D. Lentz; and Kristine A. Nichols (2012). Biochar: A Synthesis of Its Agronomic Impact beyond Carbon Sequestration. *Journal of Environmental Quality*. Vol. 41 No. 4, p. 973-989.

Jason D. Streubel; Harold P. Collins; Julie M. Tarar; and Rebecca L. Cochran (2012). Biochar Produced from Anaerobically Digested Fiber Reduces Phosphorus in Dairy Lagoons. *Journal of Environmental Quality*. Vol. 41 No. 4, p. 1166-1174.

Tsai, Wen-Tien; Sii-Chew Liu; Huei-Ru Chen; Yuan-Ming Chang; Yi-Lin Tsai (2012). Textural and chemical properties of swine-manure-derived biochar pertinent to its potential use as a soil amendment. *Chemosphere*.

Verheijen, Frank G. A.; Luca Montanarella; and Ana Catarina Bastos (2012). Sustainability, certification, and regulation of biochar. *Pesquisa Agropecuária Brasileira*. Volume 47, n.5, p. 649-653; http://www.scielo.br/scielo.php?pid=S0100-204X2012000500003&script=sci_arttext.

Villar, Amanda (2012). Biochar: A Solution to Oakland's Green Waste?. Lawrence Berkeley National Laboratory. LBNL Paper LBNL-4941E; <http://escholarship.org/uc/item/7zh0n19v>.

Wang, Ting-Ting; Jie Cheng; Xian-Jin Liu; Wayne Jiang; Chao-Lan Zhang; Xiang-Yang Yu (2012). Effect of biochar amendment on the bioavailability of pesticide chlorantraniliprole in soil to earthworm. *Ecotoxicology and Environmental Safety*.

Wang TT, Yu XY, Shen Y, Zhang CL, Liu XJ. (2012). Impact of biochar amendment on the sorption and dissipation of chlorantraniliprole in soils. *Huan Jing Ke Xue*. 33(4):1339-45.

Wenjuan (Joanna) Yang (2012). Investigation of Extractable Materials from Biochar. Master of Science in Chemistry; The University of Waikato; <http://researchcommons.waikato.ac.nz/bitstream/handle/10289/6522/thesis.pdf?sequence=5>.

Ying Yao, Bin Gao, Ming Zhang, Mandu Inyang Andrew R. Zimmerman (2012). Effect of biochar amendment on sorption and leaching of nitrate, ammonium, and phosphate in a sandy soil. *Chemosphere*.

Yingwen Xue, Bin Gao, Ying Yao, Mandu Inyang, Ming Zhang, Andrew R. Zimmerman, Kyoung S. Ro (2012). Hydrogen peroxide modification enhances the ability of biochar (hydrochar) produced from hydrothermal carbonization of peanut hull to remove aqueous heavy metals: Batch and column tests. *Chemical Engineering Journal*.

Yun Tian, Xiangyang Sun, Suyan Li, Haiyan Wang, Lanzhen Wang, Jixin Cao, Lu Zhang (2012). Biochar made from green waste as peat substitute in growth media for *Calathea rotundifolia* cv. *Fasciata*. *Scientia Horticulturae*. Volume 143, 16. Pages 15–18.