

Report on the Second International Biochar Training Course held at Zhejiang Agriculture and Forestry University (ZAFU), Linan, Hangzhou Province, China, organized by Nanjing Agricultural University in collaboration with the University of New South Wales and Newcastle University (Australia), October 2013

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Sanu Shresta from FOST in Nepal helping collect straw at a biochar amended field site.



1.0 Introduction

This training course was held in Linan, Hangzhou Province, China was organized by Nanjing Agricultural University (NJAU) and University of NSW and University of Newcastle (Australia) as a joint effort by Zhejiang Agriculture and Forestry University (ZAFU). Prof. Johannes Lehmann (Cornell University and Chairman of IBI), Dr Saran Sohi (University of Edinburgh and IBI director), Dr Ellen Graber, Principal Research Scientist at Volcani Institute Israel, Prof. Genxing Pan from NJAU and Mai Lanh Anh from Thai Nguyen University, Vietnam, all contributed lectures which was greatly appreciated. The biochar center of NJAU offered basic funding of the domestic expense for the organization and prepared field sites and biochar material, and the University of ZAFU offered laboratory for testing. The whole training program was led by Professor Joseph Stephen and Professor Pan Genxing.

A range of peer reviewed papers and various chapters + IBI guidelines on testing biochars and pyrolysis kilns, were sent to participants before the course commenced.

Participants were also sent a draft schedule and asked for input. A participatory training methodology was used whereby formal lectures were interspersed with presentations by participants, discussions on key topics with groups, and practical exercises, and a field trip to a working biochar factory and a site where field experiments have been carried out for 3 years.

Aims

- 1) To provide an overview of what is known and what is not known about:
 - a) properties of biochars as a function of feedstock, process conditions and technology;
 - b) crop responses of different biochars, incorporated at different application rates and different pre and post treatments in different eco-systems.
- 2) To provide an understanding of the principles and practice of pyrolysis and biochar production
- 3) To provide a framework that allows the development and implementation of sustainable and self-sustaining biochar projects and/or establishment of biochar businesses
- 4) To develop training materials and practical exercises and have them evaluated by the participants
- 5) To provide an interactive environment where participants can exchange information and experiences.

Participants

Over 40 people applied to come to the course and 37 attended. The organisations they represented were Government departments and authorities, Universities, businesses and NGOs. The participants from academic and business sectors of biochar came from Brazil, Brunei, Cambodia, Canada, the Cameroons, Egypt, Ghana, Indonesia, Kenya, Laos, Madagascar, Malaysia, Mongolia, Nepal, Nigeria, Pakistan, the Philippines, Rwanda, Saudi Arabia, Singapore, USA and Vietnam as well as from China.

2.0 Course Content

The following activities and lectures were undertaken

1. Traditional practices of biochar manufacture and characterisation of these biochars. Agronomic data from one traditional practice in the Cameroons was also presented.
2. The physical, chemical and electrical properties of different biochars and wood vinegar. A review of the scientific literature and assessment of areas of uncertainty. Emphasis was placed on the effect of feedstock and process conditions/technology on properties.
3. Biochar stability and how we measure it.
4. A review of the literature of different crop responses of different biochars applied at different application rates. A meta-analysis of the data was also presented as well as data from specific studies.
5. The role of biochar in land remediation, plant resistance to disease and other stresses, and animal health and growth. The interactions between various biochars and pesticides.
6. Characterisation and testing of biochars. Participants spent one afternoon in the laboratories at ZAPU.
7. A framework for choosing biochars for specific soils and plants. This topic was presented by Dr Saran Sohi and Dr Stephen Joseph and there was considerable discussion afterwards on how the participants may choose specific biochar mixes to provide a range of benefits to plants and soils.
8. Undertaking field trials. A visit was paid to a field trial on contaminated land; the trial had been started approximately 3 years ago.

9. The science of pyrolysis and the principles involved in the design of efficient low-emissions pyrolytic stoves, ovens and kilns.
10. A brief summary of the biochar reactor designs in operation and a review of the IBI guidelines for evaluating kilns.
11. How to operate biochar stoves, ovens and kilns safely. An afternoon was spent operating a TLUD drum oven and two stoves brought from Vietnam. Emissions measurements were carried out and discussion on how to reduce emissions was undertaken around the stove and drum oven.



Laboratory Practicals; Analysis of Fresh and Aged Biochars



Visit to Nintan Biochar Demonstration Plant in Nanjing, affiliated with biochar center of Nanjing Agricultural University. Rotary kiln pyrolyser working.



Open Source Pyrolyser being developed by Biochar Energy Systems in Australia to be built by Benev for China

12. How to develop and build a biochar business? A field trip was undertaken to Nanjing to see a rotary kiln pyrolysis plant operated by Nintan Biochar Demonstration Plant that had just been established. Previously this plant had operated in demonstration mode in Shanghai on municipal waste, but now was producing biochar made from agricultural residues, for sale. We also visited Benenv Co Ltd, which is developing a portable pyrolyser with the intention of manufacturing them for sale.
13. A visit to a field trial was undertaken to a rice-growing site that had been contaminated by heavy metals. Biochar had been added to the soil leading to a significant reduction in cadmium in the rice grown, to a level that is safe for human consumption. Participants had an opportunity to meet people from the local village. Following this field trip, participants spent an afternoon developing an outline business plan in groups of five people. The outline plan was presented in a group session.
14. Participants gave presentations of their experiences e.g. in either developing and field-testing biochar production technology, or and testing the biochar that was produced.
15. Biochar Systems and how we analyse them to determine possible projects that can result in carbon negative, sustainable and profitable outcomes.
16. Developing integrated biochar projects. Participants split into groups and developed 5 different projects. Some

individuals were then going to write specific project proposals when they returned home.

17. Presentation and discussions of the work being undertaken by participants.
18. Cultural and social activities. Certificate for the participants was issued by the advisors at the closing ceremony. A welcoming party was hosted by the young students from ZAFU during the training course.

Summary of the evaluation

Participants' expectations included learning the science and practice of making, testing and applying biochar, and starting biochar businesses. They also wished to make friends with people from overseas, to share experiences and to create cooperation between different organisations and institutes. Everyone said that their expectations were largely or fully met. They were overwhelmingly enthusiastic about the field trip, seeing how the pyrolyser worked and the practical production of biochar. Given the wide range of backgrounds, it was inevitable that some people wanted more science, others more practical. One participant wrote "Consider "market segmentation". Thinking about targeting different audiences, more specifically reaching out directly to whomever you want to reach, eg. village-level practitioners, extension workers... "users." The last word – "It was a well-coordinated training. Excellent teachers and dedicated staff. More power!"