Energy & Agricultural Carbon Utilization
SUSTAINABLE ALTERNATIVES TO SEQUESTRATION
JUNE 10-11, 2004
THE UNIVERSITY OF GEORGIA • CENTER FOR CONTINUING EDUCATION • ATHENS, GEORGIA • USA

SESSION ONE
ORAL PRESENTATION B

THE LINK BETWEEN TERRA PRETA DE ÍNDIO AND THE USE OF CHARCOAL TO IMPROVE SOIL QUALITY

Dr. Wenceslau Geraldes Teixeira[2] , M.Sc. Christoph Steiner[3]; Eng. Sundari Narayan Swami [1,2]; Dr. Adonis Moreira [2]; Eng. Arivan Ribeiro Reis[1, 2] ; Eng. Danielle G. Costa[1, 2]; Dr. Francisco Célio M. Chaves[2] ; M.Sc. Gilvan Coimbra Martins[2]; Eng. Grace Kely de Assis Souza, [1,2] ; M.Sc. Murilo Rodrigues Arruda[2]

[1] Scholarship Embrapa - CNPq
[2] Embrapa Amazônia Ocidental, Rod. AM-010 – Km 29, CP 319, Manaus/AM, CEP 69011-970, E-mail: lau@cpaa.embrapa.br
[3] University of Bayreuth, 95440, Bayreuth, Germany

Amazonian Dark Earth – Terra Preta de Índio - Characterization

The Amazonian Dark Earth (ADE) or Terra Preta de Índio shows normally a plaggic, terric or hortic horizons. These horizons are identified by the dark matrix colors of the top layers, and presence of ceramics and charcoal pieces. The more widely accepted theory about the origin of these epipedons is that they were improved by Amerindian populations in Pre Colombian Indian settlements. The tophorizons on ADE sites show some differences on soil chemical, physical and hydraulic properties compared to the adjacent soils in the region. The tophorizon shows typically high amounts of P, calcium (Ca), magnesium (Mg) relative to the surrounding soils.

The high amounts of soil organic matter (SOM) and black carbon strongly influence the color, the structure and the hydraulic properties. The texture is lighter and the workability of the ADE is easier, and the drainage is, habitually, very good. Because of their easy workability and longer lasting in relation to surrounding soils, the local population intensively uses those sites. ADE sites seem to be a very resilient soil type to keep their good soil physical qualities as when submitted to an intensive soil management. In this paper we discuss some investigations concerning a better characterization and expansion of the knowledge of ADE sites. Moreover the approach to reproduce those soils using as key component charcoal residues are also reviewed and discussed.

Terra Preta reproduction

Many experiment, monitoring and modeling of the dynamic of the water, nutrients and soil organic matter in soil with addition of charcoal are on ongoing research in Manaus. The first experiment at field conditions, investigating the effect of a combination of mineral fertilizers and charcoal as a mean of reducing nutrient leaching tested anual crops in a randomized complete block design with 15 treatments with five replication including organic amendment combinations with and without fertilization (compost, chicken manure, litter and charcoal). Plots fertilized with NPK and lime + charcoal application showed better plant growth as plots fertilized alone. Our first experiment with Banana showed some better mineral nutrition for N in the plants growing on plots were charcoal were applied. A second experiment with Banana at Embrapa

research station is going for the third harvest. It has an experimental design with a 3^3 confounded factorial scheme. Three dosages of charcoal were tested (0, 13336 and 26672 L ha^{-1}), as well as three dosages of phosphorous (33.4, 66.8 and 113.6 kg P_2O_5 ha^{-1}), and three dosages of nitrogen (0, 90 and 180 kg N ha^{-1}) per cycle. The mineral sources used were residues of charcoal, simple superphosphate and urea, respectively. The results of the first cycle show significant effects of charcoal applications in the weight of the bunch, the number of fruits per bunch, diameter of the fruit and diameter of the pulp. In two cycles, the weight of the bunch was not statistically significantly changed by the applications of charcoal, phosphorous and nitrogen. In spite of this, with a larger charcoal application to the soil, the second cycle showed an approximate harvest of three tones of banana per hectare. In the second cycle, a decrease in the quantity of Mn was observed along with an increase in the amount of charcoal in the soil, which could be the result of the low solubility of Mn as a function of an increase in the pH level of the soil. A new experiment with the Brazilian plant Guaraná (*Paullinia cupana*). Guaraná when cultivated adopts a shrubby habit, growing two to three m in height. It's cultivation dates to pre-columbian times. The Guaraná consists of a crystallizable principle, called guaranine, identical with caffeine, which exists in the seeds. The powder is widely available and can be mixed with water or fruit juice and some sugar in the same way. This experiment has also 3^3 confounded factorial scheme. The treatments are: charcoal, chicken manure and bones meal. This experiment started last year and the first harvest is projected to be done next year. At this experiment in addition of the traditional agronomic parameters (survival rates, growth, harvest), soil nutrient and carbon dynamics, soil water content and the effect of soil covered by charcoal in the soil temperature were monitored. As preliminary results, the soil covered with charcoal showed a temperature variation similar to soil covered with grasses and lower than the bare soil.

Charcoal and pyroligenous acid are among the growing media available in the Central Amazon region, and are subproducts of the charcoal production process, and considered as stimulants of plants especially when applied together. A experiment was conducted using a medicinal plants native to the Amazonian region, the Crajiru (*Arrabidaea chica* Verlot). Crajiru belonging to the Bignoniaceae family, is currently extracted from the forest due to specially its anti-inflammatory and astringent properties. The objective of this research was to study the development of Crajiru in the following growing media: Plantmax® (commercial growing media) ; charcoal + chicken manure; sand; sand + charcoal and soil + chicken manure. In combination with and without application of pyroligenous acid. from the evaluated parameters, it was observed that charcoal could substitute the Plantmax growing medium with similar results, since it shows the same advantages of easy access and low costs.

We are also studying the socio-economic aspects for a future proposal concerning the feasibility of “slash-and-char” as an alternative to the “slash-and-burn” land clearing method and discusses opportunities for carbon sequestration through charcoal additions to the soil under this new praxis. Moreover some challengers and topics of research are reviewed and discussed.