sludge that has been hydrothermally treated at different time/temperature regimes (h/°C: 4/180 – 4/200 – 8/200). Our initial analyses address the inorganic and organic composition of the conversion products and their impacts on germination of cress as well as on the plant mineral nutrition and growth of tomato and wheat in mixtures with inert quartz sand and soil material of a chernozem. In addition to the effects of sewchar additions on relevant soil parameters, such as CEC, WHC and plant available nutrient contents, influences of the different thermochemical treatment processes on the recalcitrance of the carbonaceous fraction will be discussed.

Nitrogen Use Efficiency of Maize after Biochar Additions to a Temperate Soil

Guerena, D*; Lehmann, J; Hanley, K; Enders, A; Riha, S

Cornell University, United States

*E-mail: dtg37@cornell.edu

Abstract: Biochar additions to tropical soils have been shown to reduce nitrogen leaching through increased adsorption capacity and greater fertilizer use efficiency. Few studies exist documenting this trend in temperate agricultural soils. To what extent the application rate of biochar affects fertilizer use efficiency is also not known. Biochar derived from maize stover produced under slow pyrolysis was applied to a maize cropping system in central New York at rates of 0, 3, 12, and 30 t ha^{-1} in 2007. Nitrogen was applied at 12.35 kg N ha^{-1} at planting and at 107.61 kg N ha^{-1} six weeks after planting. The secondary N application was applied in treatments consisting of 100, 90, 70, and 50% of 107.61 kg N ha^{-1}. Labeled isotopic 15N was applied for the 2009 season at 1 kg 15N ha^{-1} for the treatment combinations of 0 and 12 t ha^{-1} of biochar and 100 and 50% secondary N application. Free-draining lysimeters were installed 0.6m below the soil surface in these same treatments for the 2009 growing season to collect the leachate. With a constant fertilization rate of 90% secondary N, biochar application rate did not significantly affect maize grain yield. At the 50% secondary N application rate and 0 and 12 t ha^{-1} biochar there were no significant differences in maize yield or N leaching between treatments. With 100% secondary N application biochar additions significantly increased grain yields and significantly decreased N losses via leaching. Mechanisms for these differences are being evaluated through stable isotope tracing.

Investigation of potting mixes containing biochar and biochar mineral complexes for the horticultural industry

Lynch, J[a,b]*; Stephen J[a,b]; Munroe, P[b]

[a] Anthroterra Pty Ltd; [b]University of New South Wales

*E-mail: jane@anthroterra.com.au

There is a significant potential market for biochar as a component of potting mixes. The use of biochar has, for some time, been recommended in a variety of horticultural applications including as a substrate for potting mix (Santiago and Santiago, 1989). A range of potting mixes containing biochar and biochar mineral complexes were formulated for horticultural applications. The physical and chemical properties of the mixes were tested and compared with the Australian Standard for Potting Mixes (AS 3743). Detailed structural characterization of the mixes were also performed to investigate the extent of interfacial reactions between the constituent phases. Germination, toxicity and pot trials were then undertaken. Results describing the structure and composition of these materials will be described, together with preliminary results of pot trials.

Santiago, A. and Santiago, L. (1989) 'Charcoal chips as a practical substrate for container horticulture in the humid tropics', Acta Horticulturae, vol238, pp141-147

The Quantitative Differentiation Between the Presence of Carbon Basal (Humus) and Biochar Carbon In Soil Aggregates

Nelson, L[a]*; Carvajal, F., Urbina, C; Zapata, Y; Escobar, H[b]; Figueroa, L.

[a]Universidad de Tarapacá, Departamento de Química, Chile;[b]Facultad de Ciencias Agronómicas, Universidad de Tarapacá, Valle de Azapa, Arica, Chile.

*E-mail: nlarah@uta.cl

The need for suitable land for agricultural cultivation, has stimulated the search for technologies that allow the recovery and improvement of soils, such as those found in northern Chile, characterized as arid soils with low organic matter content, as well high concentrations of salts.

In this type of soil, bind the difficulties imposed by the climate typical of these latitudes, which impacts heavily on water management and water retention due to high temperatures and low humidity, which cause a high evaporation of substrate fluid in the growing areas.

The application of biochar as a soil amendment, has shown beneficial effects, because it has a more condensed chemical structure, which is very reactive toward many chemical agents, such is its almost no interaction with alkaline solvents used for solubilization of humus.

The main objective of this work is to differentiate quantitatively between the two main sources of organic carbon corresponding to the basal soil organic carbon (OC) or "humus", and the integrated biochar in soil through solid-liquid extraction alkaline solution.

To achieve this goal, we used the different chemical properties of humus and char, particularly in their chemical reactivity against alkaline solutions, subjecting soil samples from two locations in the XV region of Chile, with humus and char, using different systems extraction. The extracted organic carbon was quantified by wet oxidation with a mixture of dichromate and sulfuric acid (Walkley & Black amended), by measuring the reduced chromium molecular absorption spectroscopy UV-VIS, 600 nm, thus confirming the quantitative difference between carbon from organic soil and biochar.

The results show that the method of extraction of organic carbon is the most effective treatment solution where 1 N sodium hydroxide and sodium hexametaphosphate 4% w / v, improving the efficiency of extraction by application of heat in a system reflux, where the extraction of CO is about 80%, for soils without biochar, and about 100% in soil treated with biochar artificially in a 1:1 ratio.

The study of phosphorus fixation was performed in an alluvial soil and Lluta Aridisol Valley, in the Atacama desert in northern Chile, using as raw material for the preparation of biochar and RC, vegetable salt grass (Distichlis spicata), a very common and widespread weed in the soil of the valley. These are incorporated in increasing proportions to the ground, mixed and stirred in 1:20 with KH_2PO_4 solution containing 100 mg P / mL to reach equilibrium. The results show a gradual increase of

pH according to the presence of char and RC on the ground, and the phosphate binding capacity generated by the RC can be up to three times the fixation of phosphate generated by the char.
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Effect of biochar amendment on carbonate chemical processes in soil

Li, Guitong[a]*; Sun, Zhen-cai[b]; Lin, Qi-mei[b]; Zhao, Xiao-rong[b]

[a]Department of Soil and Water Science, College of Resources and Environment, China Agricultural University, China; [b]China Agricultural University

*E-mail: lgtong@cau.edu.cn

Soil in-organic carbon is an important C pool in semi-arid and arid zone. In arable soil, intensive input of irrigation water and fertilizer make the transformation process of soil calcite quicker. Biochar, with high CEC, nutrients in mineral form, micro-pores, active reacting groups, and special macro-molecules, will be affect the carbonate processes when be added to soil. With 2 hypothesises, 1) high CEC meaning strong absorbance for cations will have impact on fractionation of Ca^{2+} and Mg^{2+} between free ion (in solution) and absorbed ion (exchangeable), and 2) biochar, with slow decomposition and absorbing to CO_2, will result in decrease of CO_2 pressure in soil, and change the balance of solubility and precipitation of Ca^{2+} and Mg^{2+}, a laboratory experiment was conducted. Different proportion of biochar (made from wheat straw) and wheat straw was added to soil and incubated at 25, 50-60% WHC, and free air exchange with atmosphere. In situ soil CO_2 concentration and pH was measured periodically. Water soluble and exchangeable Ca^{2+} and Mg^{2+} was also measured by chemical method. Primary result showed that, 1) Biochar alone did not decomposed in soil, 2) Biochar reduced in situ soil CO_2 concentration in straw-amended soil up 40%, 3) Biochar amendment to soil increased both the water soluble Ca^{2+} and Mg^{2+} and its ratio to exchangeable Ca^{2+} and Mg^{2+}, 4) Biochar amendment to soil increased the saturation degree of Ca^{2+} and would changed chemical behavior greatly. The current result gave more clue to explore on soil carbonate chemistry under biochar amendment.

Caracterização dos Macronutrientes e a Dinâmica dos Resíduos de Lâmina de Madeira em Terra Preta Nova

Major, J[a]*; Costa, AR[b]; Kern, DC[b]; Frazão, FJL[b]

[a]International Biochar Initiative, Canada; [b]Museu Paraense Emilio Goeldi

*E-mail: julie@biochar-international.org

A Terra Preta Arqueológica possui alta fertilidade devido ao acúmulo de material orgânico depositado nas aldeias indígenas na pré-história, como prática cultural daqueles povos. Na tentativa de replicar estes solos, procurando-se alternativas para minimizar a incineração e acumulação em locais inadequados de resíduos de madeira das serrarias de Tailândia- PA, tida como um dos maiores pólos madeireiro do país, foi implantado o Projeto Terra Preta Nova. Experimento de longa duração, conta com 17 tratamentos resultantes da combinação de Carvão, Resíduos de pó de serra, Resíduos de lâmina triturada, Resíduos de ossos e Sangue + gordura. Os resultados preliminares, após seis anos, indicam uma relação positiva no incremento dos macronutrientes principalmente P, Ca, Mg e K.

Field trials in Québec, Canada: report on 2 years of biochar effect on crop productivity, and multiple biochar material testing

Major, J[a]; Husk, B[b]

[a]International Biochar Initiative, Canada ; [b]BlueLeaf Inc

*E-mail: jmajor4@bell.net

We will report on a 2-year old commercial-scale biochar trial, as well as show preliminary results for a new experiment established in 2010. A biochar field trial was established on a farm in Québec, Canada in May 2008 on a clay loam soil. Biochar from fast pyrolysis was applied using farm machinery at approximately 3.9 t/ha. Biochar was applied in a single, 1,000 m^2 swath and compared to an adjacent, unamended control swath, thus this is not a standard replicated experiment. Soybean was grown in 2008 and mixed forage species in 2009, and a large dataset was gathered including monthly data on soil physical parameters, soil chemical fertility, soil micro- and macrofauna, crop morphology, quality and yield. Yield increases in soybean averaged 19% over the control, and forage biomass was doubled by biochar application, compared to the control. In soybean, yield improvements arose from greater plant population density, as opposed to greater seed production per plant. Yield differences cannot clearly be attributed to chemical soil fertility differences among treatments. Surface soil infiltration was greater when biochar had been applied, but no differences were found in soil temperature, moisture content, and resistance to penetration. The number of nodules per soybean plant was not affected by the biochar treatment, but root colonization by ectomycorrhizae in the forage crop was greater when biochar was applied. Earthworm density was generally greater with biochar, and data on fungal and microbial grazers, and microbial and fungal biomass seem to support the hypothesis that biochar can serve as a refuge for soil microbes. Total soil carbon, soil respiration and potential organic matter mineralization were not measurably different in the biochar-amended plot. This is the first report on results from commercial scale biochar field trials in Canada.
In April 2010, two additional replicated and randomized field experiments were established on a nearby farm. The goal of these experiments is to assess the impact of three different biochar materials and the effect of soaking biochar in dairy manure prior to soil application, on crop production and soil fertility in the field, and to study the form and availability of phosphorus (P) in soil, under the various treatments. Phosphorus management in agricultural soil is seen as key for reducing eutrophication problems in this watershed, and biochar is a potential tool for decreasing P export from soil into surface water.