optimum steam-activated biochar are, respectively, 643 m^2/g and 56.9 wt %, and those for KOH-activated biochar are, respectively, 783 m^2/g and 75.3 wt %.
In this study, performances of biochar (precursor), two optimum activated biochars, and treated-activated biochars (prepared by acid-treatment and nitrogen-modification) for NH_4^+ adsorption are investigated. Long-term performance of the best activated biochar will be determined by field test. Different techniques used to characterize the porous characteristics and chemical structure of original and activated biochars are as follows: Nitrogen adsorption isotherm, Boehm titration, Fourier transform infrared spectroscopy, Elemental analysis.

Effect of corn stover biochar on the growth and water relations of a bean crop

Escobar, H[a]*; Hirsch, M[b]; Figueroa, L[b]; Urbina, C[b]; Zapata, Y[b]; Lara, N[b]

[a]Facultad de Ciencias Agronómicas, Universidad de Tarapacá; [b]Facultad de Ciencias, Universidad de Tarapacá, Av. General Velásquez 1775, Arica, Chile.

*E-mail: hescobar@uta.cl

The study was conducted in the experimental field of the Faculty of Agricultural Sciences, University of Tarapacá, Arica, Chile. The objective was to analyze the effect of biochar concentration on growth and water relations of bean cv Magnum F1. The experiment was conducted in 3 L pots in a sandy substrate with biochar corn. Irrigation was performed with a nutrient solution of Hoagland (1952) and was applied every other day when the humidity was reduced to 30% of field capacity. Before sowing, the substrate was washed three times with distilled water. The experiment considered the following treatments: 0%, 3%, 5% and 10% char. The parameters measured in plants of 20 days are for height, stem diameter, fresh and dry weight, relative water content (RWC), water potential, osmotic potential, turgor potential and stomatal conductance. The results indicate that growth factors pres entan little difference between treatments, however, the dry weight can be seen further development in plants controls without char. The CRA is very similar between treatments. The water potential tends to diminish in direct relation to increased concentration of biochar, however, these variations are rare and occur in a range of - 0.2 MPa and - 0.55 MPa. These results indicate that 10% of biochar in the substrate is more available water for the plant which could be explained by assuming that the char can act as a water retainer and maintain, therefore, a more stable saturated environment between each irrigation. This effect of biochar on the water potential, may be reflected in cell turgor (turgor potential) which also increases in direct relation to increased concentration of biochar which resulted in treatment with 10% of this char a turgor m ayor that the control without char. Stomatal conductance is a little variable factor between biochar concentrations tested, demonstrating that plants are not subject to water stress in any of the treatments the effect of char.
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Charcoal Powder and Sawdust on Nutrient Availabity in a degraded Amazonian Oxisol

Falcão, N[a]*; Comerford, NB[b]; Pereira da Silva, D[c]

[a]National Institute for Amazonian Research, Brazil; [b]University of Florida; [c]INPA-MCT

*E-mail: nfalcao@inpa.gov.br

The use of charcoal as a soil amendment is being touted as a potentially effective technique for nutrient management in tropical soils. The objective of this study was investigate the effect of charcoal, sawdust and organic compost on the chemical properties of a representative, low fertility Amazonian soil in an attempt to reproduce the fertility of Dark Earth soils. The effect of treatment 13 (120 Mg ha^{-1} of charcoal powder and no sawdust) increased pH five units higher then control plot in the soil sample showed at 0-10 cm depth. Additionally the treatment 4 (120 Mg ha^{-1} of sawdust and no charcoal) presented the lower value of potential acidity ($H^+ + Al^{3+}$).

The "Sewchar" Concept – A Strategy for the Sustainable Treatment of Human Waste and Sewage Sludge?

Führer, C*; Van Afferden, M; Müller, RA

Helmholtz Centre for Environmental Research – UFZ, Germany

*E-mail: christoph.fuehner@ufz.de

Biochar strategies evolve extra (socio) economic and environmental benefits when waste materials are used as feedstocks, that up to now have to be discharged into cost-intensive and non-sustainable treatment processes. In contrast to directly plant derived feedstocks, such as biomass from dedicated bioenergy crops or agricultural and silvicultural residues, carbonaceous materials from the wastewater sector do not face any relevant competitions by alternative utilization routes. In many developing countries human excreta are hardly treated at all and, thus, cause substantial harm to human beings and the environment. On the other hand, due to the risks of organic contaminants the reuse of sewage sludges from conventional wastewater treatment plants as soil amendments is a matter of debate in industrialized countries. Thermochemical conversion processes used in biochar production principally allow for both, the removal of pathogens and the degradation of xenobiotics. By this way, biochars from human waste and sewage sludges, so-called "sewchars", could offer benefits not only for climate change mitigation and soil amelioration but also for health and environmental protection.
In order to develop environmentally sound and economically viable sewchar strategies our long-term research program addresses aspects of conversion technology, the physico-chemical characteristics of the conversion products and the effect of these products on soil properties and plant growth under specific site conditions. Our ongoing work encompasses concepts based on i) low temperature conversion (LTC), a process for dried feedstocks related to low temperature pyrolysis and ii) hydrothermal carbonization (HTC), that enables the conversion of carbonaceous materials with high moisture contents. The HTC technology is still in its infancy and investigations of HTC products are scarce. To increase the knowledge particularly in this field we are currently comparing LTC sewchars of an activated sewage sludge with the solid and liquid conversion products of a primary

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