the added biochars (1.5% weight) on soil functions was only small, significant differences between soils mixed with different biochars were nevertheless detected. Applied PC significantly decreased the soil pH and also reduced the actual soil water content, whereas the application of CC and GC significantly increased soil water contents. Concentrations of inorganic and organic pollutants in the biochars did not exceed German environmental standards (precaution values). Our results indicate that negative side-effects of biochar application to soils might outweigh potential merits such as carbon sequestration. Properties of different biochars and their effects on soil functions such as fertility must be considered and regulated prior to the widespread use of biochar as a soil conditioner.

Biochar and plant-root interactions

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Soil amended with biochar may provide benefits to soil fertility and crop production. The improvements may be due to increased soil aeration, moisture retention and nutrient availability, and the mechanisms behind these are likely to vary with soil and plant type, as well as biochar type and rate of application. In general, biochar studies relate higher crop yields with larger root systems, but further quantification of plant roots, other than root biomass, is required: for example in terms of root growth (rate, turnover), root architecture (length, diameter, density), root health (disease resistance), and subsequent impacts on the rhizosphere (the zone of soil that is directly affected by roots) and microbial communities. Our hypothesis is that changes in root dynamics following biochar application will affect moisture and nutrient uptake, soil biogeochemical cycling, and soil carbon dynamics. To test this, the effects of sustainably-sourced charcoal (as a proxy for biochar) on cereal roots and the rhizosphere were studied. Results indicate that root proliferation was more pronounced in char-amended soil and addition of char altered root architecture (total root length, root density). Furthermore, changes in 'bulk soil' vs. 'rhizosphere soil' pH were greater in char-amended soil compared to the control. The implications for biochar will be discussed.

Aplicação de "Biochar" de Eucalipto em Solos Degradados: Atividade do solo e índices físicos

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A elevação das emissões de gases de efeito estufa (GEE) na atmosfera tornou-se um grave problema ambiental e econômico na atualidade, face as suas implicações no aumento da temperatura média do Planeta. Essa elevação é causada, principalmente, pelas emissões de CO_2 (Dióxido de Carbono) via queima de combustíveis fósseis e mudanças no uso e cobertura da terra (desmatamento e queimadas, por exemplo), as quais ocasionam alterações importantes nos estoques naturais de carbono. Isto por que, depois do vapor d'água que causa de 36 a 70% do efeito natural (não incluindo nuvens), o CO_2 é o GEE que mais contribui para o efeito estufa (entre 9 a 26%) (COLE et al., 1995; IPCC, 2007).
Dentre as novas tecnologias desenvolvidas, uma que se encontra em destaque é o "biochar" (biomassa + carvão, em inglês), por se tratar de uma tecnologia potencialmente eficaz no que diz respeito a seqüestro de carbono, além de ser apontado como de grande auxilio na fertilização agricultura, já que aumentaria a quantidade de carbono no solo possibilitando do desenvolvimento microbiano. O "biochar" é produzido por pirólise, que é basicamente a queima de matéria orgânica em ambientes com pouco ou zero de oxigênio No entanto, pensar no uso de "biochar" somente para a questão do aquecimento global esconde sua potencialidade na recuperação de solos e também na remoção via pirólise de produtos químicos indesejáveis como resíduos. Neste contexto, iniciou-se um trabalho de trabalho de pesquisa tendo como objetivo viabilizar a utilização de resíduos orgânicos na forma de "biochar" por meio de pirólise em solos degradados. Os parâmetros em estudo são: os índices físicos e a atividade dos solos incorporados com "biochar" de eucalipto em diferentes texturas e dosagens.

A Simple Method for assessing the potential of Biochar to increase Crop Productivity

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This paper describes a simple procedure to provide an estimation of the potential of biochar to increase productivity of different crops in different soil types, biochar made from different feedstocks and with different microbial additives.
The procedure does not substitute for controlled field trials. However, given the large number of permutations of soils, climate, crops and microbial additives it is impossible to test all potential biochar treatments in the field.
This procedure has the potential to allow the design of strategic and focused field trials.

Biochar como condicionante de substrato para produção de mudas de carvoeiro (*Tachigali paniculata* Aubl.)

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O avanço da fronteira agrícola no Brasil Central tem provocado problemas de degradação ambiental, com perda da biodiversidade e redução dos teores de matéria orgânica dos solos, exigindo ações de recomposição de áreas degradadas (RAD). A produção de mudas destinadas à RAD requer técnicas adequadas para obtenção de plantas sadias e aptas às condições adversas de campo. Uma das formas de produção de mudas vigorosas é o uso de condicionantes de substratos com base em compostos vegetais ricos em carbono. Apesar de estudos apontarem que solos antropomórficos da Amazônia (Terra Preta de Índio) apresentam alta produtividade agrícola sem adubação devido à alta CTC resultante da ação do carvão vegetal das antigas fogueiras dos índios, até o momento, no Brasil Central pouco se sabe sobre os efeitos do carvão vegetal pirogênico (Biochar) na produção de mudas de espécies

nativas. O objetivo deste estudo foi testar a eficiência do Biochar como condicionante de substrato para a germinação de sementes e desenvolvimento de mudas de carvoeiro (*Tachigali paniculata* Aubl.), espécie de grande importância para RAD. O experimento foi realizado no Viveiro da Universidade do Estado de Mato Grosso, Campus de Nova Xavantina. Foram testadas quatro concentrações de Biochar em pó e um controle: 5%, 12,5%, 25% e 50% e 0% do volume total do substrato base. Foram plantadas 60 sementes em cada tratamento e no controle. A semeadura foi diretamente em sacos de polietileno de 10×20 cm em casa de vegetação. A cada 30 dias, durante sete meses, foram tomadas as medidas do diâmetro do coleto, altura total e número de folhas. No final do experimento foi determinada também a biomassa seca da raiz e da parte aérea. Adicionalmente, foi testada a relação entre concentração de Biochar e umidade do substrato através de reflectômetro por domínio de tempo (TDR). Os tratamentos foram comparados pelo teste Kruskal-Wallis, regressão linear e teste qui-quadrado com correção de Yates. Os valores de altura total, o número de folhas, diâmetro do coleto, biomassa radicular e parte aérea mostraram-se positivamente correlacionados com as concentrações de Biochar (regressão linear simples, $r^2>0,9$; $p<0,01$). Todos esses parâmetros foram significativamente maiores no tratamento com a maior concentração de Biochar (50%) (ANOVA, $p<0,01$), indicando eficácia do produto para a produção de mudas em viveiro. Não foram verificadas diferenças significativas no teor de umidade do substrato entre os tratamentos, indicando não haver influência do Biochar nestes parâmetros. O Biochar pode ser recomendado como condicionante do substrato para a produção de mudas de *T. paniculata* em viveiro na concentração de 50%, assegurando melhor desempenho da espécie na recomposição de áreas degradadas ou mesmo outras finalidades.

Palavras-chave: Terra Preta de Índio, recuperação de áreas degradadas, carvão pirogênico, produção de mudas.

Effect of Charcoal And Nitrogen on Soil Arthropods Associated to Common Beans and Upland Rice

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Incorporating carbon in the form of carbonized biomass into the soil is an agricultural practice known thousands of years ago by Amazonian Indians. Nowadays it is being rescued and evaluated as an alternative to dealing with global warming. Nevertheless, the effect of modern charcoal application on soil biota must be evaluated. The effects of carbon and nitrogen fertilization on population of soil arthropods were assessed in common beans (Phaseolus vulgaris L) and rice (Oryza sativa L). The study was conducted at Embrapa Rice and Beans, Santo Antônio de Goiás, GO, from August, 26 to September, 11 2009 for common beans and from January, 07 to February 12 2010 for upland rice. The treatments were: 1. Charcoal (32 Mg / ha) + nitrogen (90 Mg / ha); 2. Charcoal (32 Mg / ha) + nitrogen (0 Mg / ha); 3. Charcoal (0 Mg / ha) + nitrogen (90 Mg / ha); 4. Charcoal (0 Mg / ha) + nitrogen (0 Mg / ha). For comparison, the same evaluations were made in plots at four sites in native cerrado forest. The experimental design was a randomized complete block with four replications. Plots were 4m wide and 10m long. Evaluations were performed weekly, using pitfall traps per plot installed between plants, standing for 72 hours. The containers with the arthropods were removed, labeled and taken to the laboratory for sorting and identification of species. All arthropods collected were sorted and packed in bottles containing 70% alcohol or pinned and stored in entomological boxes for later identification of species. The data were processed in and submitted to analysis of variance. Means were compared by LSD test ($\alpha= 0.05$). For beans, 85 morphospecies were collected, predominating ants, beetles and spiders. The total number of ant and spiders species were greater under native forest than in the crop, regardless of treatment ($P <0.05$). The number of beetles was higher in treatments receiving nitrogen, regardless of charcoal. In rice, 42 mo rphospecies were collected, mainly ants and collembolans. The collembolans predominated in cultivated environment ($P <0.05$) in plots with nitrogen. The total number of ants was significantly higher in the native forest. In the cultivated environment, arthropod populations were higher in plots treated with charcoal. Although the treatments had not provided significant changes in the populations of most species sampled, further analysis of species richness and abundance should be correlated with environmental variables for further inferences.

The enhance of soil cation exchange capacity by using charcoal in an Typic clayey Acrothoxl in the Central Amazon – Brazil

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The cation exchange capacity (CEC) of a soil is a key factor to keep soil productive capacity and and to hold the cations added by fertility management in tropical soils. In the clayey oxisols in the Central Amazon the CEC is originally low and is basically due the organic matter charges. The CEC is reduced as consequence of organic matter degradation by inadequate land use systems. The objective of this study was to evaluate the application of different charcoal levels in the CEC in the clayey yellow latossol cultivated with banana. The experiment was carried out at the Research Station of Embrapa Amazônia Ocidental in Manaus – AM. The soil was classified as an clayey Typic Acrothox. The experiment was done using a design with completely randomized blocks with in a confounded factorial (3x3) scheme with 27 treatments. The factors tested were charcoal levels (0, ~13 and ~26T ha^{-1}), phosphorus (167, 334 e 668 kg P_2O_5 ha^{-1}) and nitrogen (0, 90e 180 kg N ha^{-1}). The source of charcoal used were fine residues produced by canonization of local trees (~700 g C kg^{-1}), super phosphate simple (20% de P_2O_5) and urea (42% de N). Soil samples were collected in triplicate at each treatment in the depth of 0 - 10 cm. The CEC was determinate using an indirect methods, in which the exchangeable bases were added to the exchange acidity extracted from soils samples. The results shows significance effects ($p < 0.05$ - Tukey Test) between the level 0 (without charcoal application) and level (13336 and 26672 L ha^{-1}) and those levels do not shows differences between them. Those results shows the potential to use charcoal as soil conditioner to enhance CEC and soil fertility quality in the Oxisols. Another results about the