AGRICHAR TECHNOLOGY

The Utilization of Waste Biomass in SA as a Renewable Resource for Agriculture or Metallurgy

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At least 200,000 tonnes of waste biomass is produced in the mid north of South Australia each year. This biomass includes residues from agriculture, forestry, wood milling operations, and municipal green and domestic waste. The inherent value of this material can be recovered and utilised either as an organic soil conditioner, transformed into charcoal and utilised as a soil additive or as a coal substitute in metallurgical processes. The transformation of the biomass into charcoal using pyrolysis can provide a renewable supply of reductant to replace fossil based sources of carbon. The optimum use of the biomass will depend on various financial and environmental factors. In this work an estimate of the value of using biomass derived charcoal in metallurgical applications has been made and is compared to alternative uses such as soil additives and conditioners.

The Characterization of Pyrolysis Products Produced from Low Value Fractions of Mallee Gums

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Many potential benefits are available when charcoal derived from biomass is substituted for coal in metallurgical processes. These advantages include: lower ash and sulphur and higher reactivity and carbon content. CSIRO Minerals through the Centre for Sustainable Resource Processing (CSRP) is exploring synergetic opportunities for utilisation of the charcoal derived from Mallee biomass in metallurgical processes where high tonnages of low grade fractions could be used as a fuel and reductant. The approach not only makes the WA Mallee project more viable, it also reduces the net GHG from high temperature metallurgical processes. For example charcoal derived from these fractions has been shown to increase the reaction rate of solid state reduction processes such as ilmenite reduction in Becher kilns. The chemical process which transforms the biomass into charcoal is called pyrolysis. This work highlights the characterisation of the pyrolysis products as applied to the Mallee tree leaf/twig fractions.

AGRONOMIC AGRICHAR RESEARCH AND FIELD TRIALS

Use of Charcoal, Chicken Manure, and Bone Meal in Guarana (Paullinia Cupana Var. Sorbilis)—Preliminary Results

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Guarana (*Paullinia cupana* hbk. var. *sorbilis*) is an important agricultural product for small farmers in the Amazonas, Brazil. Guarana belongs to the Sapindaceae family and is dicotyledonous, open-pollinated (mainly by bees); in forest it is a liana and in open field is a shrub. An experiment in a factorial design with confounding technique was installed on March, 2003 with the objective of evaluating the influence of levels of chicken manure and

charcoal (0, 8 and 16L per plant) and bone meal (0, 0.2kg and 0.4kg per plant). Physical and chemical properties of the soil were evaluated. The cultivar planted was the BRS-Maués with six plants per plot, at Embrapa Research Station, Manaus, Brazil. The charcoal was triturated in fragments smaller than 10mm. All products were applied surrounding guarana plants in October, 2003. Soil samples were collected at 0 – 10cm depth in April, 2004. The soil of the experiment was classified as a yellow clayey Oxisol. The original value for pH in water was 3.1 and very low levels of available P, Ca, and Mg. The results of soil analyses showed an interaction between charcoal and chicken manure; with enhanced charcoal levels, Mg increased. It is probably because a reduction of leaching of Mg from the chicken manure. The highest level of chicken manure increased soil pH from 4.3 to 5.7, and decrease H+Al content from 7.7 to 4.4 $cmol_c\ dm^{-3}$. Chicken manure also increased P from 68 to 388 mg dm^{-3}, K from 23 to 72 mg dm^{-3}, Ca from 0.8 to 4.3 $cmol_c/dm^3$ and Mg from 0.1 to 1.1 $cmol_c/dm^3$. The results after six months of the application showed no statically difference ($p<0.005$) between treatments with bone meal and charcoal concerning values of P, K, Ca, Mg, H+Al, and pH. The results indicate no difference in the P values with enhancement of P levels from bone meal is probably due the statistical design used that confounded the level of bone meal and chicken manure. Another relevant result is that the sodium levels in soil reached a high concentration enhancing the original level of 8.0 to 67.7$cmol_c/dm^3$. It showed that use of chicken manure may cause salinization. There wasn't difference in clay dispersion between treatments, despite substantial changes in pH and Al, probably because organic matter worked as cementing, maintaining soil flocculated. The experiment is still being evaluated and long term evaluations are needed to indicate the effects of charcoal and its interactions with other products to be used as conditioner for tropical soils.

Use of Charcoal and Wood Carbonization By-Products in Agriculture: Learning With "Terra Preta De Indio"

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Brazil is the world's highest producer of charcoal, which is responsible for 38.5% of the world production. During the traditional process of carbonization, around 35% of the wood carbon is fixed in the charcoal and the rest is released to the atmosphere in smoke form and by non condensable gases (CO_2, CO, CH_4, etc.). Some technologies are adjusted in Brazil that can recover up to 50% of lost carbon in the form of condensed gases that are explored commercially for industry. The condensed smoke can be distilled producing a wide range of composites, and some by-products such as wood tar, aromatic oils, and pyroligneous liquor. Some of these by-products present chemical characteristics that are similar to the humic substances extracted from Anthropogenic Black Earths and other pyrogenic carbon rich soils suggesting its potential use as raw material for the organic conditioner production. Another important by-product generated in the process is fine charcoal that, in some cases represents up to 15% of the produced charcoal. Reactive organic molecules could be produced from acidified charcoal. These molecules have functional groups that are able to hold nutrients and water in the soil, and are very stable due its polycyclic aromatic structure. The development processes that allow the transformation of charcoal and its by-products into composites with appropriate characteristics for the use as organic conditioner, with high reactivity and stability, is highly desirable and strategic for the agricultural and forest activities in Brazil. Products with these characteristics can enhance the value to the charcoal by creating an innovative uses for a traditional product and to represent a clean development mechanism that has the ability to receive carbon credits considering its long term carbon fixation potential due to the transference of the carbon from the atmosphere to a steadier soil organic matter basin. This work has the objective to congregate experiences and expertise on the agricultural use of coal and its by-products, and to supply information on the availability of these products in Brazil. In such a way one expects to present to the reader the dimension of the impact and